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UMI

A SURVEY OF FACTORS

AFFECTING COMPUTER IMPLEMENTATION

IN RURAL NORTHEAST TENNESSEE K-12 PUBLIC SCHOOLS

———————

A Dissertation

Presented to

the Faculty of the

Department of Educational Leadership

and Policy Analysis

East Tennessee State University

———————

In Partial Fulfillment of

the requirements for the Degree

Doctor of Education

———————

by

Carl Steven Rapp

December 1997

APPROVAL

This is to certify that the Graduate Committee of

Carl Steven Rapp

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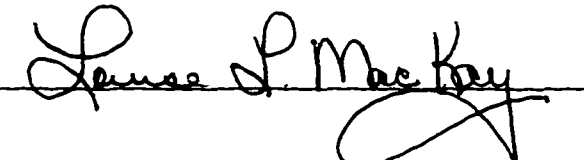
twenty-eighth day of May, 1997.

The committee read and examined his dissertation, supervised his defense of it in an oral examination, and decided to recommend that his study be submitted to the Graduate Council, in partial fulfillment of the requirements for the degree of Doctor of Education in Educational Leadership and Policy Analysis.
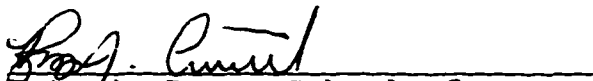
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Signed on behalf
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ABSTRACT

A SURVEY OF FACTORS

AFFECTING COMPUTER IMPLEMENTATION

IN RURAL NORTHEAST TENNESSEE K-12 PUBLIC SCHOOLS

by

Carl Steven Rapp

The purpose of this study was to examine the variables that are apparently affecting the incorporation of computer technology in Northeast Tennessee rural K-12 public schools. Therefore, the present study investigated the relationship between the independent variables--gender, age, and prior experience, and the dependent variables--knowledge about, attitude toward, and use of computer technology among Northeast Tennessee teachers and principals.

This study utilized a survey methodology seeking responses from teachers and administrators in Sullivan, Hawkins, Johnson, Washington, Carter, and Unicoi counties. The findings were based on the return of 208 completed surveys which represented a 52% return rate.

Based on the findings of the study the following conclusions were reached: First, the overall level of access to computer hardware and software in individual schools is not adequate if computer technology is to become part of the students' learning. Second, schools are providing little or no teacher training in using computer technology for lesson planning, delivery of instruction, research, or to promote hands-on student learning. Third, teachers and administrators believe that computer technology would be extremely helpful in their work now, and in the near future (5 years from now). Fourth, teachers and administrators believe that computer technology will be almost indispensable in the schools of the near future. Fifth, male and female educators report similar attitudes toward, knowledge about, and use of computer technology. Sixth, educators of different ages report similar attitudes toward and use of computer technology. Educators of different ages, however, do not report similar knowledge of computer technology. Seventh, teachers and principals with

different levels of prior education experiences report similar attitudes toward, knowledge about, and use of computer technology. Eighth, in planning future training computer training programs, it is probably not necessary to differentiate groups according to personal attributes such as gender, age, and prior experience. Ninth, the potential for the instructional use of computer technology has not yet been realized.

The following recommendations were suggested: (1) there should be enough computer technology for teachers and principals to have unrestricted access, (2) there should be sufficient and adequate computer technology training for teachers and principals offered at the local level, (3) there should be adequate support and time for teachers and principals to learn how to use technology and plan for its use in the school setting, (4) this study should be expanded and replicated to include a larger sample size of educators from all across the state of Tennessee, (5) the relationship between age and knowledge of computer technology should be further investigated, (6) teachers and principals who are proficient in computer technology should serve as role models and peer tutors for those who want to learn how to use computer technology, and (7) district and building administrators should provide computer technology training and planning during the school day.

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The writer would also like to thank all of the teachers and administrators for participating in this study and special thanks to Dr. Gunapala Edirisooriya for his guidance in the statistical analysis of the study.

Special thanks are also in order for the continued support and unconditional love of my wife, Mary and my son, Steven, as I complete this facet of my lifelong learning.

Most importantly, I thank God for giving me the strength and faith I needed to complete this study.

But they that wait upon the Lord shall renew their strength; they shall mount up with wings as eagles; they shall run, and not be weary; and they shall walk, and not faint (Isaiah 40:31).

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CHAPTER 1

INTRODUCTION

Computer technology is becoming more crucial to education in the United States every day (Betts, 1994; Hancock & Betts, 1994; Mandell, 1991; Mecklenberger, 1991; Stinson, 1994; Taitt, 1993). Schools, now more than ever before, need to be incorporating computer technology into the curriculum. It is unfortunate that "even though the pace of technological innovation continues to accelerate in our society as a whole, in schools such innovation lags far off the pace" (Hancock & Betts, 1994, p. 24).

Several recent surveys (AEL-TEA, 1991; Becker, 1991a; Becker, 1991b; Bigham, 1993; Niemiec, Samson, Weinstein, & Walberg, 1987; U.S. Congress Office of Technology Assessment, 1995) report that computers are not being utilized to their fullest potential in schools.

Computer technology is becoming increasingly important in the workplace today. A survey by the American Society for Quality Control indicated that 83% of respondents thought that computer technology made it easier for them to do their jobs (Johnson, 1993). To secure a position and advance in that position, it is essential that upon graduatin high school students have developed basic computer skills in word processing, spreadsheets, desktop publishing and graphics (Swope & Wrisley, 1993).

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The passage of the *Goals 2000: Educate America Act* is a step toward the goal of widespread use of computer technology in our schools. One hundred five million dollars in federal funds are being used to develop curriculum frameworks with computer technology plans. States are competing for $5 million to support technology planning activities that provide systemic reform and promote high standards of achievement (Donovan & Sneider, 1994).

Even more recently, the federal government has shown that computer technology has a high priority in education reform. One of the goals of President Clinton's education agenda is to connect every classroom and library to the Internet by the year 2000, and to help all students become computer literate (National Science Teachers Association, 1997). Implementation of computer technology is a key priority in President Clinton's 1998 budget with funding for education technology being increased to $500 million (U. S. Department of Education, 1997a).

State education leaders are concerned about the role of computer technology in schools. For example, in 1990, the Michigan state board of education developed 14 goals referred to as "Education: Where the Next Century Begins." A major goal of the plan was to design a five-year state technology plan (Michigan Department of Education, 1992). To incorporate computer technology in the schools the

"Classroom of Tomorrow" program was initiated. The major goals of the program were twofold: (a) "to inspire Michigan students and teachers to utilize instructional technology and (b) to improve the skills of tomorrow's work force" (Al-Obiedat, 1994, p.5). A program of accelerated computer distribution throughout the state was initiated to accomplish these tasks. Currently, many of these kinds of programs are in progress throughout the United States.

The Tennessee State Board of Education in 1991 initiated the <u>Master Plan for Tennessee Schools: Preparing for the Twenty-First Century</u> to help incorporate computer technology in public elementary and secondary schools (Tennessee State Board of Education, 1991). The plan focuses on three key areas: (1) establishing a twenty-first century classroom; (2) creating a rational, workable accountable governance system; and (3) providing adequate, sustained school funding. The twenty-first century classroom area of the plan focuses on the incorporation of computer technology in Tennessee's public elementary and secondary schools (Tennessee State Board of Education, 1991). The vision of the 21st century classroom is as follows:

> Teachers and students will be supported by a new kind of classroom, a learning environment organized to facilitate cooperation among teachers and equipped with state-of-the-art technology that will change the way

students learn and the way teachers teach. Technology
will not be thought of as an end in itself, but as a
means to bring the world to the classroom and to make
possible the targeting of individual interests and
needs. Educators will finally be freed to go beyond
providing for groups of students and allowed the
opportunity to focus on individuals. They also will
accept responsibility to do well for all of their
students, regardless of the problems these children may
bring with them. (Tennessee State Board of Education,
1991, p.8)

This vision is forward looking and is a milestone for
K-12 public education in Tennessee. Computer technology is
important for our students because it can: (a) make students
more active learners; (b) help students work at their own
pace; (c) encourage creative original expression; (d)
empower students to take on new roles as peer tutors, as
leaders in learning explorations, and as organizers of
spontaneous work groups; (e) improve higher-order thinking
skills; and (f) give students the opportunity to use the
technology of today's real business world (Prentice Hall
Multimedia, 1995).

Computer based-instruction reportedly has a positive
effect on learning. The Software Publisher's Association
(1993), in an analysis of over 250 technology studies,
reports that raising student achievement is approximately

30% more likely to happen with computer-based instruction than without it. Specific gains in achievement are addressed in chapter two.

A study by Bigham (1993) and a joint study by the AEL-TEA (1991) suggested that, generally, teachers in Tennessee were not integrating computer technology into the curriculum. Jim Oakes, an education consultant with the Tennessee State Department of Education, reported that approximately 10% of Tennessee's classrooms had twenty-first century computer technology (personal communication, December 4, 1995).

This percentage, however, is increasing. According to the U.S. Department of Education, Tennessee is already among the top five states in the nation in the amount of state money invested in technology for schools. The state has provided more than $108 million in special funds for educational technology since 1993-94. "This includes $84 million to provide training and state-of-the art technology for 5,459 Twenty-first Century classrooms, and $3 million to provide yearly training, state salary support and benefits for 212 local technology coordinators" (Tennessee State Department of Education, 1996a, p. 1).

A 1996 survey that included 77% of the 139 local school systems and the state special schools showed an average ratio of one computer for every 9.7 Tennessee students. An average ratio of teacher to computer is one computer for

every 5.9 teachers. According to technology coordinators and special school educators responding to the survey 87,603 computers are in the schools, including 8,523 teacher workstations, 67,804 student workstations, and 4,551 other computers used by teachers and students (Tennessee State Department of Education, 1996b).

The ConnectTEN project was initiated in 1994 with a goal of connecting Tennessee's 900,000 students, 50,000 teachers, and 1,560 schools to the Internet. According to Governor Sundquist (1996), as of October 10, 1996, about 800 schools had been connected. Approximately $5.6 million has been earmarked by the Department of Education for hardware and installation of computer equipment.

Howard D. Mehlinger (1996), director of the Center for Excellence in Education at Indiana Univervsity, Bloomington, believes a technology revolution is occurring in schools, despite the lagging implementation of computer technology in some regions. According to him, schools can expect more integration, interaction, and intelligence from future computer technology. Even though there has not been enough time or money for the purchase of computers, for training, or for support, transforming schooling through technology will succeed.

Statement of the Problem

Even though computer technology is becoming more widespread, teachers in rural K-12 Northeast Tennessee public schools are not utilizing computer technology to its fullest potential. According to an AEL-TEA survey (1991) several reasons for this exist:

- Lack of computer access
- Lack of funding
- Lack of time
- Lack of training and experience, and
- Fear of change.

Purpose of the Study

The purpose of this study is to examine variables that apparently are affecting the incorporation of computer technology in Northeast Tennessee rural K-12 public schools. Therefore, the present study investigated the relationship between the independent variables-gender, age, and prior experience, and the dependent variables-knowledge about, attitude toward, and use of computer technology among Northeast Tennessee teachers and principals.

Limitations

This study is limited to rural public K-12 Northeast Tennessee schools in the counties of Washington, Sullivan,

Carter, Hawkins, Johnson, and Unicoi since the majority of the schools in these county systems are rural.

Significance of the Study

Results of this study provide information describing how groups of teachers and principals differ in their needs for training or retraining in computer technology. This information may help determine the current status of computer use in Northeast Tennessee rural public K-12 schools, as well as stimulating the use of computers in the schools. A summary of the study results will be shared with the Tennessee State Department of Technology Education so that its staff members may customize their technology training according to the needs of principals and teachers.

Concerns about the lack of use of computer technology in Northeast Tennessee K-12 public schools led to the following research questions for this study.

Research Questions

1. Do teachers and principals of different gender report similar attitudes toward computer technology, knowledge about computer technology, and the use of computer technology?

2. Do teachers and principals of different ages report similar attitudes toward computer technology,

knowledge about computer technology, and the use of computer technology?

3. Do teachers and principals with different levels of prior educational work experiences report similar attitudes toward computer technology, knowledge about computer technology, and use of computer technology?

Hypotheses

As a result of the review of literature, the following hypotheses were developed for this study.

Null Hypothesis (1): There is no relationship between gender and attitudes toward computer technology.

Null Hypothesis (2): There is no relationship between gender and knowledge about computer technology.

Null Hypothesis (3): There is no relationship between gender and use of computer technology.

Null Hypothesis (4): There is no relationship between age and attitudes toward computer technology.

Null Hypothesis (5): There is no relationship between age and knowledge about computer technology.

Null Hypothesis (6): There is no relationship between age and use of computer technology.

Null Hypothesis (7): There is no relationship between prior educational experience and attitudes toward computer technology.

Null Hypothesis (8): There is no relationship between prior educational experience and knowledge about computer technology.

Null Hypothesis (9): There is no relationship between prior educational experience and use of computer technology.

Definitions

Key words used in this study are defined below:

Attitude: "An individual tendency or predisposition to evaluate an object or the symbol of that object in a certain way" (Katz, 1960, p. 168).

CD-ROM: an acronym for Compact Disk-Read Only Memory; "general term applied to a variety of storage formats by which audio, text, and graphics are retrieved by a laser beam that scans tracks of microscopic holes in a rotating compact disk. The disk can store over 600 million characters, but the user cannot store new information or alter the existing information" (Freedman, 1992, p. 92).

Computer: "An electronic device which is able to accept data, apply some processing procedure to it and supply the resulting new data in a form suitable to the

user" (Ellington, 1986, p. 24). "They can keep records and do administrative tasks, they can be powerful tools to augment or enhance the learning experience, and they can deliver instruction" (Siegel & Martin, 1986, p. 19).

Knowledge: Familiarity, awareness or understanding gained through experience or study.

Large screen projection system: Either a 32-inch television monitor or an LCD projection panel that may be placed on an overhead projector and connected to the computer to provide an enlarged image that can be easily seen by students in the classroom (Jim Oakes, personal communication, December 4, 1995).

Modem: An electronic device that serves as a "translator" so that computers may interact with each other (Adams, Krockover, & Lehman, 1996).

NCE or Normal Curve Equivalency Score: "A type of standardized test score having a mean of 50 and a standard deviation of 21.06. NCE scores allow comparisons between results of different tests" (Borg & Gall, 1989, p. 692).

Rural: Meaning county school systems only.

Software: In this study software means "computer programs and procedures concerned with the operation of an information system" (O'Brien, 1988, p. 15).

Student work station: A computer with a minimum of a 486 microprocessor, four megabytes of random access memory,

a 3.5 inch floppy disk drive bay, and a CD-ROM drive (Jim Oakes, personal communication, December 6, 1995).

   <u>Teacher work station</u>: Includes the following; computer, laser printer, laser disc player, conversion box (computer to television monitor), large screen (32-inch) television monitor, modem, and workstand (Jim Oakes, personal communication, December 4, 1995).

   <u>Videodisk (laser disc</u>): "A disc on which video signals, with or without sound, are electrically or optically recorded. Such discs have a variety of instructional applications, and are particularly important in the field of interactive video" (Ellington, 1986, p. 179).

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<u>Procedures</u>
</div>

Procedures for this study were as follows:

1. A survey used by Veronica Pasko-Lyons (1993) in her study of Pennsylvania schools was modified (with the author's permission) to use in the collection of data.

2. The population for this study was 400 educators in Johnson, Carter, Washington, Sullivan, Hawkins, and Unicoi county school systems.

3. The Tennessee Department of Education provided the names and addresses of the Superintendents of these counties.

4. Permission to conduct the study was obtained from the superintendents and names and addresses of educators were obtained.

5. A pilot study was conducted in Washington County, Virginia.

6. A cover letter and the <u>Teacher/Principal Technology Survey</u> were sent to 400 educators on November 18, 1996.

7. On December 2, 1996, a postcard was sent reminding those that had not returned the survey to return it as soon as possible.

8. Upon receiving the completed surveys, the data were scored and recorded. The data were analyzed using univariate analysis of variance (ANOVA).

9. The results of the study were reported and summarized.

<u>Overview of the Study</u>

Chapter one includes the introduction, statement of the problem, purpose of the study, limitations, significance of the study, research questions, hypotheses, and overview of the study.

A review of the related literature concerning computer technology is found in chapter two. This chapter is organized in the following way: introduction, an overview of computer technology, status of computer use in Tennessee K-12 public schools, positive aspects of computer technology in K-12 schools, negative aspects of computer technology in K-12 schools, obstacles to the incorporation of computer technology, variables that affect the incorporation of computer technology in Northeast Tennessee K-12 public schools and the summary.

Chapter three consists of a description of the research design for this study, the population, the survey instrument, procedures for collecting data, and the methods used for analyzing the data.

Research findings of the study are presented in chapter four.

Conclusions and recommendations of the study are presented in chapter five.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Introduction

This study is concerned with incorporation of computer technology in Northeast Tennessee rural K-12 public schools. The relationship between the independent variables—gender, age, and prior experience, and the dependent variables—knowledge about, attitude toward, and use of computer technology among Northeast Tennessee teachers and principals is explored because the degree of incorporation of computer technology in schools in other states appears to have been effected by the above independent variables (Pasko-Lyons, 1993).

To help provide a foundation for this study, the literature is organized in the following way: 1) an overview of computer technology, 2) status of computer use in Tennessee K-12 schools, 3) positive aspects of computer technology in Tennessee K-12 schools, 4) negative aspects of computer technology in Tennessee K-12 schools, 5) obstacles to the implementation of computer technology, and 6) variables associated with the implementation of computer technology in Northeast Tennessee K-12 schools.

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An Overview of Computer Technology

By the end of the 1980s the number of computers in U.S. schools had increased almost fifty times, from 50,000 in 1980 to about 2,400,000 in 1990 (Becker, 1991a). At three different times during that decade, the Center for Social Organization of Schools at Johns Hopkins University conducted national surveys on computer use in U. S. schools. The first survey, conducted in 1983, found that computers were so scarce in the schools that very few students had any substantial experience in working with them. In 1985, the second survey determined that computers were being used mostly as enrichment and not as a regular means of instruction. Even then the computers were used for basic programming or for computer literacy (Becker, 1991a). "Teachers rarely used computers as a regular means of providing students with instruction or practice in traditional school subjects" (Becker, 1991a, p. 396).

The third survey, in 1989, involved 1,416 U.S. schools and determined that 98% of the schools had one or more computers. Of the 3,062 teachers in the survey, 1,943 used computers for student instruction in at least one of the classes they taught (Becker, 1991a). According to Becker (1991b), in 1989 the typical high school had about 45 computers and the average elementary school had approximately 20 computers.

Many of these 1980s computers, the "model T's" of the 1990s, are still in the schools today. According to Mecklenburger (1990), the number of students in U.S. schools today might outnumber truly adequate computers by as much as 700 to 1. Today, as in 1990, computer technologies in the schools have not nearly kept pace with computer technologies in the industrial world.

For the school year 1992-93, Quality Education Data (QED) reported that the use of computers for instructional purposes had changed dramatically from 16% in 1981-82 to 98% in 1992-1993 (QED, 1991-92, 1992-1993). The ratio of students to computers (including the "model T's") had also changed. In 1984, the average school had one computer for every 125 students, while in 1992-1993 the ratio was one computer for every 16 students (QED, 1992-1993).

In April, 1995, the U.S. Congress Office of Technology Assessment issued a report titled Teachers and Technology-Making the Connection. The report estimates there are 5.8 million computers in the public schools of the United States. This is about one computer for every nine students. At least one television and one videocassette recorder is found in almost every school, and 41% of teachers have a television in their room. Only 12% of teachers, however, have access to such technologies as CD-ROM and computer networks. A recent study conducted by Quality Education Data (QED) found that the national average ratio of students

to multimedia computers is 35 to 1 (The United States Department of Education recommends a ratio of 5:1). A multimedia computer was defined as a Macintosh or IBM-compatible with at least a 386 processor that could support CD-ROM drives and/or sound cards and video cards. The information was derived from 14,201 school districts and 84,851 public schools (Division of Chemical Education, Inc. of the American Chemical Society, 1996a).

U. S. school districts will spend an estimated $4.1 billion on educational technology in school year 1996-1997, as compared to $3.9 billion in 1995-1996. In 1996-1997, this will translate into $92.70 per student; in 1995-1996, actual spending per student on educational technology was $90.17. Less than 3% of technology expenditures will be spent on on-line services while hardware purchases will make up 62% of technology expenditures (Division of Chemical Education, Inc. of the American Chemical Society, 1996b).

Although computers are becoming more prevalent in the schools, a substantial number of teachers indicate they do not use computers for instruction. A majority of teachers report feeling inadequately trained to utilize computer technology and are not aware of how technology can help them conduct the many aspects of their jobs (Bigham, 1993). To be able to use these tools well, teachers must possess vision of technologies' potential and the opportunities to apply them. Some schools have made great progress in

helping teachers use basic computer applications such as word processing, but most schools are still struggling with curriculum integration, that is necessary if computers are to become a really effective resource (U.S. Congress Office of Technology Assessment, 1995).

The federal government has funded several projects to help implement computer technology in schools. In Tennessee, the "Schools for Thought" project involves 37 consortium members and Metropolitan Nashville Public Schools. Students are using computers to improve their achievement in mathematics, science, and literacy. Project SMART (Science and Math Advancement Radically Raised Through Advanced Technology) involves five school districts in West Tennessee that participate in the University of Memphis Professional Development School Partnership. This project is designed to provide sustained, intensive, high quality professional development for teachers in the use of computer technology to improve mathematics and science instruction (Lori Tate, personal communication, April 18, 1997).

The West Virginia Infomine Network is designed to enhance and expand the existing statewide computer networks to provide West Virginian's access to local, state, national, and international information resources via a single unified system that will link the West Virginia Academic Library Network with the West Virginia Library Commission's Statewide Network. The project will provide

computer network service to educational institutions and libraries in all 55 counties of the state (Lori Tate, Appalachian Educational Laboratory, personal communication, April 18, 1997).

Another West Virginia Initiative, The Eisenhower Mathematics and Science Consortium at Appalachian Educational Laboratory, has the following objectives:

- establish a network of collaborators to coordinate resources;

- identify exemplary practices;

- develop and implement strategies to ensure that teachers have access to instructional materials, assessment tools, and professional development programs; and

- increase teacher use of technology for networking and classroom instruction (Lori Tate, personal communication, April 18, 1997).

The Franklin County Public Schools in Virginia have formed a twelve-member consortium in the project, "Accepting the Challenge". As part of a comprehensive school reform initiative, the project integrates computers and appropriate information technology into the curriculum at all grade levels. The Norfolk Virginia Public Schools, along with 41 partners, have formed "The Education Connection". This collaborative is using networked technologies, computer-

based education materials, and audio-visual resources to create and distribute new curriculum and train teachers (Lori Tate, personal communication, April 18, 1997).

Many states are taking initiatives to instigate change in the schools through technology. Indiana, with the cooperation of the State Superintendent of Public Instruction and the Governor, focused on school change in three areas: "implementing site-based decision-making, increasing parental involvement, and developing innovative curriculum and instruction" (Khan, 1992, p. 3). Part of the curricular changes involved introduction of the computer by providing school-wide computer networks and computer labs in six pilot schools. A major program goal was to utilize computers as tools of active learning in all areas of the curriculum (Khan, 1992).

The West Virginia K-12 RuralNet Project has been initiated to help science and math teachers open the world of Internet to improve classroom instruction. One of the goals of the project is to develop a pool of 40 science and mathematics teacher-leaders trained in the use of Internet resources to serve as mentors and peer trainers. A second goal is to develop an on-line community of 1200 elementary and secondary science and mathematics teachers using the Internet to plan and deliver quality instruction congruent with West Virginia's new science curriculum framework. The

final goal of the project is to evaluate the effectiveness of the program (Wiesenmeyer & Howley, 1996).

Virginia implemented its first six-year technology plan in 1990 and it has provided more than 10,000 computers for middle-school students. The current six-year plan (1996-2002) has recognized the following school needs:

- more local area networks (only 31% of Virginia's schools have local area networks);

- additional access to the Virginia Public Education Network (PEN), a statewide Internet system;

- additional classroom computers with a five-to-one, student-to-computer ratio; and

- training programs and incentives to enhance teaching through the use of computer technology (The Vision, 1996).

The Indiana Buddy Project, started in 1988, provides students in the entire state with computers, modems, and printers to use at home. In this way, students are spending more time engaged in learning and parents are becoming more involved in their children's learning (Insight, 1993; Betts, 1994).

In Kentucky, educational reform is tied to technology, especially to computers. Forty-eight million dollars worth of educational technology is being coupled to changes in curriculum. "Technology is one means of obtaining

educational equity. Technology provides the vehicle and the format for doing entirely new things" (Bruder, 1991, p. 8).

The Master Plan for Education Technology was implemented by the Kentucky Board of Education in 1992 and updated in 1996. The Master Plan goals include:

- one high-performance, networked computer for every six students;
- one high-performance, networked computer for every teacher;
- four to six active network connections in every classroom;
- a cordless telephone and video technology in every classroom;
- a full function local area network in every school;
- instructional software available to everyone from the network; and
- a direct, high-speed connection from every school to the information highway (The Vision, 1996).

Implementation of computer technology in Kentucky has progressed rapidly. In 1992, one percent of school districts had technology coordinators; in 1996, 100% have technology coordinators. In 1992, no district had state-funded computer training for teachers; in 1996, there have been 12,500 person days of state-funded teacher training (The Vision, 1996).

The Classrooms of Tomorrow program in Michigan is supplying about 18 million dollars worth of computers to its teachers so that computers might be integrated into the classroom to promote active student learning (Bruder, 1991). Bruder (1991) reports that the Central Kitsap School District in Washington with its Strategy 2020 program is providing computers for its schools "as a blueprint for techniques that actively engage the student and the teacher" (p. 8).

The School Net Project will bring computer technology and telecommunications to students in Ohio's schools. With $95 million dollars allocated for the project, it is projected that every classroom in the state will be wired with coaxial and copper cable and computers with CD-ROM will be provided for 14,000 classrooms over the next five years (Kinnaman, 1994).

Table Rock and Heritage Middle Schools in Burke County, North Carolina, have a computer on every teacher's desk and four student computers in every classroom. Additionally, each teacher's computer is connected to a large-screen monitor, laserdisc player, and VCR (Insight, 1993). "The schools' computers are connected via Token Ring networking, which means that educational courseware and CD-ROM materials can be accessed from any computer " (Insight, 1993, p. 5).

The Oregon Education Act for the 21st Century, passed by the Oregon Legislature in 1991, provides for computer-

based instruction for at-risk students in the form of alternative learning centers (Engel, 1992). The learning centers were created to offer "teaching strategies, technology, and curricula that emphasize the latest research and best practice" (Goldman & Conley, 1994, p. 4) to ensure student success.

In 1988, the Washington State Board of Education awarded funds to 21 school districts and schools for implementation of technological innovation for the Schools for the 21st Century Program (Johnson & Vaughn, 1992). Colon School District, a small rural district, was funded. Many changes occurred in their school system during the next five years. The ratio of computers per student went from 1 to 40 in 1987 to 1 to 2 in 1992, while the ratio of computers per teacher changed from 1 to 20 to 1.5 to 1 (Johnson & Vaughn, 1992).

The Governor of West Virginia, Gaston Caperton, has succeeded in putting in place a $200 million, 10-year reform package to place computers in every elementary classroom by the year 2000 (Armstrong, Yang, & Cuneo, 1994).

Many states have proposed spending large sums of money to acquire computer technology in their schools. It is not surprising that large sums of money are needed when looking at what is considered "essential technology". According to Wilson (1996/1997), the "ideal technology school" should have the following computer-related equipment:

- A local area network (LAN) composed of Macintosh and IBM-compatible computers, laser and dot-matrix printers, scanners, file servers connected to each classroom, student workstation and faculty workstation, routers and repeaters, remote access capability, inter-building routers and frame relay, and high speed access to a local Internet access provider;

- LAN head-end equipment including large academic and administrative file servers, library catalog server, and World Wide Web home page server;

- A wide area network (WAN) composed of all district schools and buildings connected to the WAN and E-mail accounts for all employees;

- Full access to Internet with student and teacher access available simultaneously; and

- Telnet capability to all libraries.

At Central Virginia Governor's School for Science and Technology, multiple science technology laboratories have been incorporated into the curriculum. The technology labs are offered in a senior seminar and include instrumental chemical analysis, holography, nuclear science, computer-aided design, desktop publishing, robotics, electron microscopy, telecommunications, general microbiology, and biotechnology. For these technology labs to be implemented successfully in other schools the following advice is offered:

- Involve small teams of teachers and community resource people;
- Allow flexible planning periods for teachers;
- Limit class size to about 20-30 students;
- Use the World Wide Web to find resources;
- Start out on a small scale and upgrade;
- Create various technology labs to encourage interdisciplinary thinking;
- Be consistent with format to establish continuity;
- Encourage students to develop new projects;
- Allow time for students to reflect on their experiences; and
- Consider carefully older equipment that may be donated by local businesses (Lindeman & Bishop, 1997).

It appears that the public at large supports implementation of computer technology in schools and places great significance on teacher training. A survey conducted by Public Opinion Strategies (1996) shows that two-thirds of Americans would pay a monthly fee or tax to ensure that all children in public schools would have computer access. Seventy-one percent of voters strongly felt schools in poverty or rural areas should receive financial assistance so that they could have the same computer access as students in wealthy districts. Increased teacher training in computer use was the top choice among voters who feel

schools are less prepared to teach students the technological skills they will need in the 21st century.

As technology becomes more widespread, educators must assume new roles. Administrators and teachers will have greater responsibility for coordinating access to technology and the allocation of resources across many school sites. Martorella (1996) reports:

> Once customized information is readily available via emerging technologies from many sources, teachers and administrators will have more time to spend with individual students. Technology will offer teachers and administrators new solutions to problems attendant on large classes and violent students. Educational environments would be secure and nurturing. Violent and disruptive students, who are a risk to themselves and others in large school settings, will be directed to therapeutic and/or punitive agencies. These would be offered technology-based instructional alternatives as well as counseling. (p. 40)

Cradler (1997) reports implementation of technology in California's schools was not becoming institutionalized because it was often treated as an "add-on" rather than being implemented into the curriculum. State curriculum frameworks, for example, did not include technology applications nor were these applications included as a part of school improvement plans. Teachers often were not

included in technology decisions at the school level. Classroom planning is essential if computer technology is to be successfully implemented in schools. Cradler (1997) offers these steps for effective planning:

1. Address student needs and instructional priorities.

2. Design classroom-specific instructional activities.

3. Develop computer-based applications to support the instructional activities.

4. Individualize staff development for teachers.

5. Use classroom-specific performance-based assessments.

6. Determine hardware, software, and other technology resources needed.

7. Obtain school management commitment to ensure that the time and resources needed to implement the plan are available.

8. Develop a budget for the teacher to implement the plan.

Classroom planning has been found to consistently increase teacher commitment and produce sustained levels of technology use. Proper planning can lead to successful technology training. The teachers must be involved in developing their training (Desrosiers, 1997).

Status of Computer Use in Tennessee K-12 Schools

A survey of 449 teachers conducted by the Appalachian Education Lab and Tennessee Education Association (AEL-TEA) study group (1991) found that 59% of responding educators considered themselves to be computer users but that overall respondents did not feel well informed about computer technology. Computers were most frequently used for mathematics and reading instruction and thinking skills (AEL-TEA, 1991).

Of the 449 respondents, only 25 reported having access to a computer either in their classroom or elsewhere in the school building. Six teachers indicated that students had access to a computer in the classroom and 11 responded that students had access to computers in a lab. Forty-three percent of the educators reported that students used computers on a daily basis and 30% reported weekly student computer use (AEL-TEA, 1991).

Bigham (1993) reported very infrequent computer use by students in both rural and non-rural settings in her survey of Tennessee science teachers. "One hundred percent of rural teachers and 94.7% of non-rural teachers claimed that their students used the computer less than weekly" (p.4). Teacher computer use was also quite low, with 53.1% of the rural educators and 55.4% of the non-rural educators indicating that they used computers less than weekly. Only

15.5% of the science teachers (rural and nonrural) used computers for instructional purposes (Bigham, 1993).

Rouse, Switzer, and McInturf (1997) conducted a survey of Internet use in Johnson City, Bristol City, and Sullivan County Schools, Tennessee. They found that 29% of responding teachers in Bristol City Schools used the Internet everyday, 39% of those in Johnson City Schools, and 24% of those in Sullivan County Schools. Thirty-one percent of Bristol teachers used the Internet only a few times a month, 25% of those in Johnson City, and 42% of those in Sullivan County. Information from the Internet was integrated into lesson plans for 62% of responding teachers in Bristol City Schools, 71% in Johnson City Schools, and 66% in Sullivan County Schools. Internet training was provided through the school system for 63% of Bristol teachers, 61% for Johnson City teachers, and 61% of Sullivan County teachers.

According to a survey conducted by Quality Education Data (1992-93) in 1992, Tennessee ranked forty-fifth in school computer usage when compared to other states. The ratio of students to computers was 21 to 1 (Quality Education Data, 1992-93).

A more recent Quality Education Data (1996) survey ranked Tennessee forty-third compared to other states in students per computer. Tennessee's ratio of students per multimedia computer was 38 to 1 and the ratio of students to

computer (any kind of computer) was 13.7 to 1. Although Tennessee has invested approximately $108 million in computer technology since 1993 (Tennessee State Department of Education, 1996a), the state was far behind other states in computer technology and is still trying to catch up.

Lack of computer use in Tennessee schools has been addressed in The Master Plan for Tennessee Schools: Preparing for the Twenty-First Century initiated by the Tennessee State Board of Education in 1991. While many areas of education are the subject of this plan, the main concern, here, is implementation of technology. The stated technology goal of the plan is: "State-of-the-art technology will be used to improve instruction and learning in all schools, to provide professional development, to manage schools and school systems, and to link all schools in a statewide information network" (Tennessee State Board of Education, 1991, p. 24).

Under the Master Plan, teachers must submit plans showing how technology will be used in their classrooms to promote instruction, and the local school district must provide 25 percent matching funds for the project; the State of Tennessee will provide $69.9 million for the plan. The Master Plan also states that teachers must receive 30 hours of computer training (Kinnaman, 1994).

The funding package is designed to create more than 3,000 21st Century Classrooms, each of which will be

provided with at least $20,000 worth of technology,
including a multimedia teacher workstation, a laser
printer, two student workstations, a CD-ROM drive, a
videodisk player, and a large-screen presentation
system. Additionally, a minimum of $2,000 must be
spent on software for each classroom in the program.
(Kinnaman, 1994, p. 20)

One strategy for implementing the plan included
appointing an educational technology committee to find the
best uses of computer technology for instruction and
professional development. Goals for instruction included
the following: "technology to provide access to information;
computer applications to facilitate learning objectives
including reading, writing, and mathematics" (Tennessee
State Board of Education, 1991, p. 25). Both of these
strategies were implemented in fiscal year 1993.

The Master Plan for Tennessee Schools: Preparing for
the Twenty-First Century seems to have been successful in
placing computers in the classrooms. A 1996 survey that
included 77% of the 139 local school systems showed an
average ratio of one computer for every 9.7 students and an
average ratio of one computer to every 5.9 teachers. A
total of 87,603 computers are in the schools, including
8,523 teacher workstations, 67,804 student workstations, and
4,551 other computers used by teachers and students
(Tennessee State Department of Education, 1996a).

Favorable Aspects of Computer Technology in K-12 Schools

Great changes are occurring in schools throughout the United States because of computer technology. For example, at the Narrangansett School in Gorharn, Maine, use of the computer and multimedia technology is being pioneered in producing electronic portfolios of students' work. As students move from level to level their work is added to the portfolio and upon graduation, each student will receive his or her entire portfolio as a CD (Pearlman, 1991).

Students at Willard Model Elementary in Norfolk, Virginia have shown tremendous progress in learning because of computers. In 1987 a computer lab with reading software packages was installed. In 1990-91, 63.2% of Willard's fourth-graders passed Virginia's standardized literacy test. In 1991-92, the rate jumped to 70.6 percent, and in 1992-93, it rose to 84.8 percent (Szabo & Hotch, 1993).

Adlai Stevenson High School in Lincolnshire, Illinois, uses computers in almost all classes from programming in BASIC, PASCAL, and LOGO to word processing and desktop publishing, and from computer-aided design to graphic arts to computer interfacing in physics and math. Their coaches use computers for planning and scouting (Taitt, 1993).

In Tucson, Arizona, Maxwell Middle School has 60 Compaq notebook computers that students can take home for an evening or even a weekend. Students can access reference works or other educational applications at school via modem.

Many parents are also becoming more involved in their child's education because of this unique program (Hoffman, 1995).

Devitt (1997) expounds six reasons for infusing science with technology. First, technology is the perfect tool to excite students about science. By immersing students in inquiry-based learning as outlined in the National Science Education Standards, and helping them understand the role of technology in that process, teachers can provide students with skills that will extend far beyond the classroom. Second, technology can provide access to worlds previously unknown and connect students with real scientists. Third, students have the opportunity to apply themselves as scientists and realize the thrill of discovery. Fourth, computers allow learners to explore the "what if" domain to enhance problem solving and critical thinking skills. Fifth, the exciting world of simulation can be explored making the impossible possible. Last, the use of computer technology will keep teachers and students abreast of the changing science knowledge base.

Hancock and Baugh (1991) have found increased enthusiasm for learning as a result of student computer use. Elementary teachers in the Jefferson County Public Schools of Louisville, Kentucky reported:

● a positive attitude toward learning;

- students learn a great deal while working at the computer without realizing they are learning;
- using Logo has significantly improved thinking strategies and enriched geometry understanding and skills; and
- students write longer, more involved stories working at the computer and make more revisions of their work. (p.17)

The middle school teachers also found favorable changes as a result of students using computers. They found:

- students indicate the only reason they like school is because they get to use technology;
- students are involved in creating learning materials, not just viewing those created by an unknown person;
- they do not miss on computer days; and
- students are proud of their work, which reflects in their increased self-esteem. (p.17)

High school teachers were equally impressed with the use of computer technology in the school. They indicated:

- students fear writing less;
- improved spelling, literary form, and usage/mechanics;
- more interaction between students of various ability levels;
- improved test scores for at-risk students;
- 100% participation in all computer projects; and

- higher student attendance during writing activities involving the computer lab. (p. 17)

One hundred and eighty students at the Ronald McNair School in Queens, New York, have almost abandoned textbooks and drill and practice workbooks for a network of 30 computers. Sylvia Leslie, a fourth grade teacher at the school, has seen some amazing gains in learning; some students' test scores have jumped from the 70-79% range to the 90-95% range since the introduction of the computer. Students are also gaining on national achievement scales (Eng, 1994).

> The U.S. government minimum is for every student to show "0 NCE" (Normal Curve Equivalency), which means that in one school year, a child has done the work required. In New York, the requirement is 1 NCE, twice the federal minimum. According to the New York City Board of Education, the 144 kids in McNair who logged more than 20 hours in front of a PC last year showed an impressive 8 NCEs in math. (Eng, 1994, p.86)

The Colton School District in the state of Washington has seen great success in implementation of computer technology in its school system. They applied for and received a grant under the Washington State Board of Education's Schools for the 21st Century Program (Johnson & Vaughn, 1992).

Student achievement increased, not as measured by the traditional norm-referenced testing, but by the non-traditional methods of the number of books and reference materials checked out by students from the school library, by increases in the quality of student writing as measured by holistic assessment measures, and by action research conducted by regular classroom teachers at all grade levels. (Johnson & Vaughn, 1992, p. 29)

Principal Walter Otto has introduced four mobile computer labs, each consisting of a wheeled cart holding 18 Macintosh Powerbooks, at Rancho Santa Margarita Intermediate School in Saddleback Valley, California. The notebook computers serve a dual role; they are used by the students during regular school hours and then are assigned to teachers to take home (Hoffman, 1995).

Roselle, New Jersey is the home of Abraham Clark Junior/Senior High School, a school with a large minority population. Project Pulse-Pupils Using Laptops in Science and English-was launched four years ago at the school; one eighth grade class each year has 24-hour access to notebook computers. The English teacher, the science teacher and the computer supervisor also have 24-hour access to the laptops. All notebooks are linked to the school's computer bulletin board by internal modems. Project-based science and writing activities utilizing the notebook computers and the bulletin

board are produced by a collaborative effort between the English teacher and the science teacher (Hoffman, 1995).

Hellgate Elementary School District, consisting of slightly over 1,000 students in grades K-8, in Missoula, Montana, is not a rich school district. More than half of its students are eligible for federal free and reduced-price breakfasts and lunches. The administration spends $3100 per student annually (Whitehead, Cain, & Graves, 1994).

A computer network was installed in all elementary classrooms greatly enhancing the student's education. The mean math scores on the California Test of Basic Skills jumped 20 percentile points in one year after network installation. This unusual increase in math scores was attributed to the computer network and the math software that was used (Whitehead, Cain, & Graves, 1994).

Columbus Middle School, New Jersey has seen a great change in achievement of its students since the influx of $10 million from Bell Atlantic. Five hundred computers were placed into classrooms and homes of 200 seventh graders at this poor inner-city school. In two years, test scores have increased and dropout rates have fallen dramatically (Smith, 1996).

Research concerning implementation of technology in Washington state schools concludes that:

- Educational technology has produced a significant positive effect on achievement within all major subject areas;

- Educational technology has resulted in positive effects on student attitudes toward learning;

- The level of effectiveness of technology is influenced by the specific population, the software design, the teacher's role, how the students are grouped, and the level of student access to technology;

- With the introduction of technology into schools, learning has become more student centered and teacher-student interactions have increased; and

- Computer-based networks have increased student-student and student-teacher interactions, especially with lower-performing students (Washington State Department of Education, 1997).

A study conducted by the Center for Applied Special Technology (1996) compared the work of 500 students in fourth-grade and sixth-grade classes in seven urban school districts in Chicago, Dayton, Detroit, Memphis, Miami, Oakland, and Washington DC. Results of the study suggested that students who use the Internet become more independent, think more critically, find information more quickly, organize, and evaluate it, and use the knowledge they gain to express themselves in compelling ways.

Robert C. DeMarco, physics teacher at Barker Central School, Barker, New York, finds many advantages in using computer interfacing in the physics laboratory. For teachers, the interfacing allows them to demonstrate and display many topics that previously could only be presented orally. Students grasp basic concepts more quickly once they see or work with them on the computer. Interfacing also allows students to graph complicated equations more easily and perform complicated math computations. As a result of computer interfacing, 80% of seniors enrolled in physics in 1995. Students, by learning to use modern technology, are much better prepared for the real technology-driven world of work (Pasco Scientific, 1996a).

Thomas Fanman, Supervisor of Science at Hunterdon Central Regional High School in New Jersey, also has found advantages in using computer interfacing in his physics class. Teachers are encouraged to become facilitators rather than disseminators of information. Students become self-directed learners and enjoy learning. A recent Educational Testing Service study of 176 students from eight Hunterdon classrooms showed that 100% of the students believed that computers enhance instruction (Pasco Scientific, 1996b).

Jim McPhee, physics teacher at Penn Harris High School in Mishawaka, Indiana, similarly has found advantages using computers in the laboratory. Students learn to think like

scientists because they envision new ways of solving problems. Approximately 50% of students enrolled in computer-based physics classes pursue college degrees in engineering while 30% pursue university science degrees (Pasco Scientific, 1996c).

Larry Baker, physics teacher at East Bank High School in Charleston, West Virginia, offers these advantages of computer interfacing in the physics laboratory:

- An 18% increase in upper-level science enrollment;

- Six percent increase in Comprehensive Tests of Basic Skills (CTBS) scores in Science and Reference Skills;

- Over 160 computer-based experiments have been developed; and

- East Bank has become an international model school; 24 teachers from Japan visited the school to observe the model program (Pasco Scientific, 1996d)

Pasco Scientific (1996e) found the following benefits of using computer interfacing in science laboratories:

- Computers increase student motivation;

- Students become much more productive and efficient in the lab;

- Student comprehension and retention improve with instant feedback from the computer;

- The computer enhances the integration of the National Science Standards into the curricula;

- Learning can proceed at the student's own pace;

- Visual learning is enhanced; and

- Computers make students aware of and able to use resources outside of the classroom.

Computer technology is making a notable positive impact in education. Interactive Educational Systems Design, Inc. (1996) summarized educational technology research from 1990 through 1995. The study is based on 176 research reviews and reports on original research projects. Seventy of the studies were published in professional journals and 33 were doctoral dissertations. These 176 studies were selected from an original group of more than 1000. Some of the more significant findings of this study are:

- Leadership of a school-level technology coordinator and district-level involvement are key in developing a learning environment conducive to successful computer use;

- Exemplary computer-using teachers benefit from social interaction with other computer-using teachers;

- Exemplary computer-using teachers usually have smaller class sizes and more funding for software acquisition;

- Teachers must carefully plan learning activities that use tool software;

- Teachers with more than 10 years of computer experience provide students with a higher demonstrated knowledge of subject, critical thinking, teamwork, and presentation skills;

- University and in-service teacher training provides teachers with increased comfort in using computers, an increase in desire to use computers and a better understanding of how to integrate software into the classroom curriculum;

- Greater student cooperation and sharing and helping behaviors occurred when students competed against the computer rather than against each other; and

- Small group collaboration on computer is especially effective when students have been trained in the collaborative process.

Negative Aspects of Computer Technology in K-12 Schools

A review of the literature found few negative aspects of computer use in the schools. Apple (1992) expressed some concerns about the widespread use of computers in education. He expressed fears that the computer would become a tool of the wealthy, leaving out the poor and disadvantaged. He stated: "Before we give schools over to the requirements of the new technology and the corporation, we must be very certain that it will benefit all of us, not mostly those who already possess economic and cultural power" (Apple, 1992, p. 48).

Apple (1992) predicted that the high costs of computer technology would increase the already wide social imbalance

between the haves and have nots. "Schools in inner-city, rural, and poor areas will be largely priced out of the market, even if costs continue to decline. Thus, the computer and computer literacy will 'naturally' generate further inequalities" (p. 50). Research shows that in middle-class schools more computers are available than in working-class or inner-city schools populated by children of color.

Gender differences are also apparent; "two out of every three students currently learning about computers are boys" (Apple, 1992, p. 51). According to Apple, tracking and streaming of students will also cause gender impact. Business tracks, where mainly word-processing skills are learned, generally attract more young women than men. Academic tracks stress computer programming and software utilization and are disproportionately filled with young men. Apple (1992) states,

> While many teachers and curriculum workers have devoted considerable time and effort to equalize opportunities and outcomes of females in mathematics and science, where curricula already contribute to the reproduction of gender differences, the problem still remains and can be worsened by computerization of these subjects. p. 51)

Horbeck and Arth (1991) reported that many middle-level schools had not developed comprehensive plans for

integrating and using technology in the schools. Voltz
(1994) indicated that while many teachers understood the
need for change and were willing to change, they had little
or no experience with computer technology and reverted
frequently to more traditional teaching techniques. There
seemed to be a lack of technology training for the teachers.

Other teachers seemed to be so overwhelmed with
computer technology potential that they over-emphasized
computer use and excluded important parts of the curriculum.
"High-tech activities were sometimes incorporated into the
curriculum before any objective was identified in reference
to them" (Voltz, 1994, p. 3).

Obstacles to the Implementation of Computer Technology

Computer technology is enhancing student learning all
across the country. It is helping students learn to read
and write, to solve problems, to think critically, to
communicate clearly, and to cooperate with others. It is,
therefore, difficult to believe that there are barriers to
its implementation.

According to Hardin and Ziebarth (1996) many factors
are affecting the slow implementation of computer technology
in schools. For example, teachers entering the profession
have not been required to be computer proficient in order to
graduate from college. In some cases, administrators have

no knowledge of the value of computer technology and are unwilling to realign school budgets to include it in the curriculum. Deficient preservice preparation of teachers in the use of computer technology also has resulted in slow implementation. Insufficient in-service professional development programs and a lack of specific curriculum benefits or of resources for teachers to use in their courses are other factors that have impeded implementation of computer technology in schools.

The Colton School District in Washington State, however, found it very difficult to convince parents and school board members that computer technology was an essential tool in student learning today. When computers were introduced in each elementary classroom, parents complained and many had the impression that "kids in America don't know their basic skills, because all they have to do is punch a button on the computer to get the answer" (Johnson & Vaughn, 1992, p. 4). The administration and staff quickly developed a parent education program to show parents that computers were important tools of learning and were not used to play games (Johnson & Vaughn, 1992).

Some new board members, having the same perceptions as some parents, wondered how the district was benefiting from all the time, money, and effort spent on computer technology. To help change these perceptions, students and teachers gave presentations about technology at every

regular monthly board meeting for an entire year. Board members also educated themselves about technology by attending state-level workshops on technology (Johnson & Vaughn, 1992).

Parents and board members did not understand how computers were being used in schools. Computers had not been part of their education as they were growing up. "Thus they did not have a personal frame of reference to compare this new innovation with their own school experience" (Johnson & Vaughn, 1992, p. 10).

Dan Lumley, director of secondary education and technology, Unified School District 253, Emporia, Kansas, and Gerald Bailey, a professor in the department of educational administration, Kansas State University, offered some strategies to help avoid the obstacles the Colton Elementary School had in dealing with some board members. They included:

- Define for the board their proper role in technology.

- Orient board members to the emerging technologies. Studies have shown that board members often do not know about technology's potential to improve and revitalize teaching and learning.

- The board must learn that educational technology decision-making is often more complex than in other areas.

- Communicate the following truisms: technology programs rarely work perfectly from the start, technology is expensive, obsolescence is a fact of life, teacher training is ongoing and difficult, and facilities often have to be renovated.

- Assist the board of education in preparation of a mission statement.

- On-going communication with the board of education is essential to building technology-rich schools (Lumley & Bailey, 1992).

Rebecca Burns, a Training Specialist in the Appalachian Educational Laboratory's Classroom Instruction Program, reported that teacher fears about computer technology could be a great barrier to school computer use. Some teachers felt that computers were going to make learning very impersonal and that they might even replace teachers (Burns, 1990). Teachers are here to stay; their role in the instructional environment may change because of computers but socialization is also part of a student's education and teachers will always foster this socialization.

Lack of appropriate computer training for teachers can be a major hindrance to implementation of computer technology in the schools (Buzbee, 1995). A survey in Instructor magazine (1991) reported that 51% of the respondents thought that better and more training would help them make more effective classroom computer users. Sixty

percent of the teachers responding reported that the typical in-service computer course was unsatisfactory.

This lack of training is the reason that "instead of taking advantage of the computer to present new ideas in new ways, teachers reported that they used the machines for drills, as word processors, and for remedial work, particularly mathematics and science" (Snider, 1992, p. 318).

Joni Logan, principal of Fort Myers High School in Fort Myers, Florida faces the same problems of many other principals. She has 85 new computers in her classrooms and no one to deal with computer maintenance or teacher training (Harrington-Lueker, 1996). States are investing heavily in hardware but are forgetting about personnel needed to maintain all this new equipment. It seems more investment needs to be made in computer training. A 1995 survey of technology coordinators indicates an average of 8% of their technology budgets are spent on teacher training. However, 28% reported not spending any money at all on technology staff development (Harrington-Lueker, 1996).

Lovely (1996) has suggested four training models to help administrators provide computer training for their faculty.

- The Old Model: Listen Watch, Go Back, And Do- This training model is supposed to save money by exposing as many educators as possible to technology at the same

time. This model, however, is not very effective in most cases. It can be effective only if the technology topic is very short and specific.

- The See-It Through-Students'-Eyes Model- Computer training is provided to teachers and students teamed together. This is effective because it allows teachers to see activities through their own students' eyes.

- The Curriculum-Rich Model- Teachers frequently find that technology, when it is carefully connected to curriculum, is not as complex or threatening as they had thought.

- The Do-As-I-Do Model- Teachers work at classroom learning centers to develop their own technology knowledge while receiving guidance when needed.

Another barrier is inadequate software. Of course, not all software is inadequate, but it seems that schools have been a dumping ground for less-than-effective software since the introduction of the computer. "Throughout this century poor-quality programs, dull pictures, and unreliable software have disappointed teachers and led them to reject the new machines" (Snider, 1992, p. 323). To be effective, the software must engage and it must reach educational objectives. Software also must have varied presentation modes so it can be used with whole-class discussion to introduce ideas and concepts, with several users to support

cooperative learning groups, and for individual learners (Dawson, 1996/1997).

A less obvious obstacle is the tendency of industry to use schools as a place to dispose of computers that have become a bit obsolete or that were not designed for school use in the first place (Snider, 1992). Most schools, of course, gladly accept the computers assuming that even out-dated computers are better than none. Then, when the computers do not work as anticipated or the appropriate software cannot be used with the computers, teachers become discouraged.

Another barrier is persuading book publishers to produce electronic texts and ancillary materials for computers. McGraw-Hill, Inc., the leading textbook publisher in the United States, does not believe the computer is yet the central role of instruction (Armstrong, Yang, & Cuneo, 1994). Companies, more recently, however are making greater strides in producing ancillary computer materials. Prentice Hall (1996), for example, is providing an interactive CD-ROM and a website for their new book, Astronomy Today. The CD-ROM also contains 23 video clips from the Space Telescope Science Institute, an electronic, hyperlinked version of the entire text, 42 updates to keep the text current, and animations to illustrate astronomy concepts. The website has an on-line archive for each chapter, recent images from the Hubble Space Telescope,

astronomy links, and on-line exercises (Prentice Hall, Inc.
1996). Companies such as Living Books, Broderbund Inc.,
Scholastic Inc., Microsoft, Voyager Inc., and Simon and
Schuster Interactive/-Byron Priess have produced electronic
books for elementary students (Herring-Harris, 1996).

Technological innovation is accelerating rapidly in
society as a whole, but it seems that schools are lagging
far behind. Hancock and Betts (1994) report:

> A key obstacle to the use of technology in schools is
> the limited support teachers have for integrating
> unfamiliar technologies into instruction. As a
> result, teachers frequently avoid new technologies or
> use them for purposes other than those for which they
> were designed. (p.24)

For computer technology to be successfully incorporated in
schools, teachers must have time and support to explore new
technology.

> One of the most important supports for teachers is to
> have someone at the school site trained to maintain and
> repair equipment. Those who know technology should be
> lead teachers who are available to assist other
> teachers when things go wrong. (Burns, 1990, p. 11)

When the Hellgate Elementary School District in
Missoula, Montana, decided to install computers in all
classrooms, some teachers were somewhat reluctant to have
the computers in their rooms. They indicated that they

would feel more at ease in a computer lab with a technician to attend any problems that might arise. With administrative and peer support these reluctant teachers, however, soon became very confident about having and using computers in their rooms (Whitehead, Cain, & Graves, 1994).

Lack of time is another problem when trying to implement computer technology. Sheingold and Hadley (1990) reported that before teachers make computers part of their educational program, seven years of administrative support, staff development, and planning time are required. To help promote the idea that computers are a better way to reach students, teachers need to have the technology in their hands to experiment with it. They suggested that this may be accomplished by utilizing any or all of the following:

- Rent-to-own agreements in cooperation with local business.

- Professional contract revision to recognize that the ability to do productive work is not restricted by time or place.

- Teachers-only electronic tools provided in the classrooms, teachers' lounges, or library/media centers.

- Technology loan programs for teachers' home use.

- Technological competency requirements in all teacher education qualifications.

- Telephone lines in every classroom (Hancock and

and Betts, 1994, p. 29).

Recent research has found that the lack of planning for technology has been a serious weakness in trying to implement computer technology. Jack L. Edwards, a member of the Zion Elementary District 6 Board of Education in Illinois, suggests the following points to consider when planning for technology:

- A comprehensive strategic plan is the only sound basis for introducing technology. A strategic plan includes a vision statement and a definition of the strategies to get you there.

- Involve everyone who will implement the plan. A common vision is the cement that holds the process together.

- Begin to keep and share information from magazines, handouts, notes conferences, technical reference sources, and videotaped training sessions.

- A frequent mistake is assigning planning to the resident technophile, who knows technology but may not be tuned in to curriculum needs or training needs of the less knowledgeable.

- Planning needs to be long term and systemic, but implement a little at a time.

- Expand your definition of basic skills to keep pace with change.

- Communicate with and listen to the world outside the schools.

- Decide what problems you need to solve; then shop for technology to solve them.

- Do lots of research before plunking down money (Edwards, 1994).

Andrew Weiss (1996), technology plan manager for the Chappaqua, New York Central School District, suggests one of the most striking omissions from technology plans has been realistic modeling of technical staffing. Few superintendents or planning teams have realized that a large group of computers and related equipment will require a substantial group of trained professionals to cope with potential problems. Many technology planners do not recognize the enormous complexity of the equipment needed to connect schools to the Internet.

Smith (1996) reports that the obstacles between schools and the Internet are too vast to be overcome in a few years. For example, in California's Silicon Valley, the average elementary student is three years younger than the average computer. Many of these computers are not integrated into the curricular planning at all.

According to Smith (1996), in most states, budget battles still center on teacher salaries and textbooks, not computers. The most overlooked obstacles, however, are the telephone lines needed to network computers. Installation of these lines requires a considerable amount of money; someone has to pay and schools, at the present, clearly

cannot afford these costs. To install these lines and computer networks in University School in Johnson City, Tennessee, for example, will cost approximately $45,000 (Bill Smith, personal communication, April 10, 1997). This is probably why only about 2% of classrooms in America have phone lines (Smith, 1996).

A survey of New York and Rhode Island superintendents in 1989-1990 (Morton, 1996) showed that 85% of them knew nothing about computers, had never used a computer, and had no intentions of using one. Clearly, this vision has to change for successful computer implementation in schools.

In the same years, a national survey of 500 universities and colleges was conducted to determine whether computer training of any sort was included in courses for educational administrators. Only 2% of institutions surveyed said that they offered computer training as part of the administrative program. Fourteen percent offered training through other departments and the rest offered nothing. Computer-based curriculum training was not provided and only 7% of their professors used computers in their courses (Morton, 1996). "Unfortunately, changing classroom practices so that they unleash the potential of computer technology will never occur if purchase-order acquisitions of new hardware and infrastructure items take precedence over quality staff development opportunities" (Moersch, 1996-1997, p. 54).

It is not surprising, to find, therefore, that many school administrators shun development of computer use in their schools and often misdirect planning for it. It is also not surprising that, when financial worries surface in schools, computing is one of the first areas to be cut (Morton, 1996).

Most of a state's education department is made up of administrators who set educational policy development and funding of school programs. Their lack of vision concerning educational technology has been shown in the following situations:

- California cut its innovative computer program five years ago. The program integrated technology into classrooms with trained support teams.

- New York has divided the responsibility for computer-use development in such a way that mass confusion has plagued the state and no one knows what to do.

- For 15 years, Massachusetts has left school technology planning to local authorities and has only recently begun to develop a state-wide plan.

- Utah has given responsibility for developing school computer technology planning to a university-based group; the same group is responsible for training educational administrators (Morton, 1996).

It appears that many educational administrators do not recognize the importance of computer technology in schools.

"Educational administrators must understand that the promise of computer environments is that they support changes in the educational structure, in instructional processes, and in the development of lifelong learning within the whole population" (Morton, 1996, p. 419).

School boards and administrators must move away from transactional leadership routines. They must move toward transformational leadership that promotes communication, empowers participants, and encourages faculty to solve problems collaboratively. Principals, who are mainly responsible for implementation of computer technology at the building level, must be trained on the importance of technology and the need to find strategies to encourage faculty to use the new technology. If the superintendent does not provide direction to principals, serious setbacks in the implementation of computer technology may result. The superintendent must be a transformational leader and prepare administrators for change (Cooley, 1997).

Perhaps a change in administrator's attitudes toward computer technology use in schools is on the horizon. U. S. Secretary of Education Richard W. Riley and the Department of Education have formed a partnership with the National Association of Secondary School Principals (NASSP) and the National Association of Elementary School Principals (NAESP) to respond to President Clinton's Call to Action for American Education (U.S. Department of Education, 1997b).

One of the ten goals expounded in the plan emphasizes connection of every classroom and library to the Internet by the year 2000 and help for all students to become computer literate.

Velma Walker (1997), Director of the Office of Advanced Technology, Detroit Public Schools, believes that computer technology has not been as available to teachers and administrators as needed due to scarce or unwise use of resources and often technology-apprehension of those involved in decision-making processes. Walker (1997) states:

> We must give our teachers and students the technology available today to enhance, motivate, and stimulate learning. Universities, school districts, and businesses must make a collaborative contribution to the training of teachers on the daily use of technology. (p. 48)

Variables That Affect the Implementation of Computer Technology in Northeast Tennessee K-12 Schools

Research by Bigham (1993) shows that computers have had very little impact on science education in Tennessee's secondary schools and that student and teacher computer use is very infrequent. In many schools computers are not being used at all. Computer availability seemed equitable among

non-rural schools and rural schools. Seventy-nine percent of the rural respondents had 0-2 computers per school available for classroom or laboratory use; 74.4% of the non-rural science teachers had 0-2 computers per school available per teacher (Bigham, 1993).

Computers were used infrequently by students. When the science teachers were surveyed, 100% of rural teachers and 94.7% of the non-rural teachers indicated that their students used the computer less than weekly. Of the 200 science teachers responding to the survey, only three of the non-rural teachers said that their students used a computer on a weekly basis (Bigham, 1993).

Teachers' computer use was not much more prevalent than that of their students. "Over half (53.1 %) of the responding rural teachers, and 55.4% of non-rural teachers, said they used computers personally less than weekly" (Bigham, 1993, p. 4).

Some startling statistics were discovered when the science teachers responded to the question about the primary purpose for using the computer. Eighty-three percent of rural and 86% of non-rural teachers did not use computers for instruction. "On average, only 15.5% of all Tennessee science teachers, rural and non-rural, did use computers for instructional purposes" (Bigham, 1993, p.5).

Computers are being used for instruction in few Tennessee secondary schools. What has happened to the

Master Plan for Tennessee Schools: Preparing for the Twenty-First Century? Data in this study do not seem to support the Plan's mission statement: "To ensure that Tennessee Schools are among the best in the nation" (Tennessee State Board of Education, 1991, p. 7).

The technology goal of the plan states: "State-of-the-art technology will be used to improve instruction and learning in all schools, to provide professional development, to manage schools and school systems, and to link all schools in a statewide information network" (Tennessee State Board of Education, 1991, p. 9). Perhaps this study can shed some light on what has happened.

Another survey of computer use was conducted under the auspices of the Tennessee Education Association and the Appalachia Education Laboratory (AEL-TEA, 1991). Results indicated that 59% of teachers who were then using computers did so for instructional purposes. Of 449 Tennessee teachers surveyed, 25 reported having access to a computer somewhere in the building where they taught. Six teachers indicated that students had access to one or more computers in their classrooms; 11 reported that students had access to computers in a lab (AEL-TEA, 1991).

According to the survey, 43% of students use computers for instruction on a daily basis. Thirty percent of the teachers indicated weekly instructional use of computers by their students. Teachers also reported that the computer

was most frequently used for enrichment and remediation, not for curriculum integration (AEL-TEA, 1991).

A survey of teacher Internet use by Rouse, Switzer, and McInturf (1997) in Bristol City Schools, Johnson City Schools, and Sullivan County Schools found that less than 40% of teachers used the Internet for instruction.

The three foregoing studies were the only recent research found conducted since 1991 in this review of related literature. The study by Bigham (1993) seems to indicate that implementation of computer technology is hindered mostly because of the way teachers have been taught. Teachers teach the way they have been taught; for the most part their training did not involve computers. Therefore, teachers resist change. The AEL-TEA study (1991) indicates that lack of funding, lack of time, and lack of training (and incentives to get the training) were also variables that affected implementation of technology.

Summary

Computer technology holds great promise in solving some educational problems; it is not a cure for all; it is not nor will it ever be a replacement for a teacher. Good computer software complements good teaching. Computers can be used as beneficial tools to enhance student learning. They can motivate and invigorate students and teachers.

These positive learning aspects can become reality when computers are integrated into the curriculum. This integration is the most effective way to use computers in schools, not as drill and practice or remediation devices.

The only three studies done on computer implementation in the Tennessee schools within the last six years did not address relationships of gender, age, and prior experience with knowledge about, attitude toward, and use of computer technology among Northeast Tennessee teachers and principals. This study examines these relationships.

This review of related literature has presented a comprehensive overview of computer technology, status of computer use in Tennessee K-12 schools, favorable aspects, negative aspects, obstacles to implementation , and variables that affect implementation of computer technology in rural Northeast Tennessee K-12 schools.

Chapter three consists of a description of the research design for the study, the population, the survey instrument, procedures for collecting data, and the methods used for analyzing the data.

CHAPTER 3

METHODOLOGY

Introduction

School systems in the United States face a very important challenge in preparing students for the twenty first century. Changing technologies and vast amounts of information are making the challenge more difficult. Implementation of computer technology in the schools, however, can help solve this problem. As shown in the literature, many factors may be related to implementation of technology in schools. This study investigated the relationship among the predictor factors gender, age, and prior experience and the following response variables:

1. Attitude toward computer technology

2. Knowledge about computer technology

3. Use of computer technology

A survey instrument (see appendix A) designed by Veronica J. Pasko-Lyons (1993) used in her dissertation concerning computer use in Pennsylvania colleges and universities was modified based on a panel of experts (used with the author's permission) for this study. The original Pasko-Lyons survey instrument was modified after consultation with a panel of experts.

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Overview

The methodology of the investigation is included in this chapter. It gives a description of the research design, the population, the survey instrument, the pilot study, reliability and validity, procedures for collecting data, and methods used for analyzing the data. Inferential statistical research techniques were used in collection and analysis of data to test hypotheses concerning the study.

The purpose of this study is to survey variables affecting implementation of computer technology in Northeast Tennessee K-12 public schools in county school systems. Therefore, the present study investigated the relationship between gender, age, and prior experience of the teacher/principal and attitude toward technology, knowledge about technology and use of technology. A survey instrument (see Appendix A) was used to collect needed data to test the stated hypotheses.

Description of the Survey Instrument

Except for demographic items, the instrument used a Likert-type format (Likert, 1932) for each response. Each response was given a score of 0 to 4, with a score of 4 being more positive and a score of 0 being the least positive.

Six sections are included in the instrument. Parts I, II, and III representing knowledge about computer technology, use of computer technology and attitude toward computer technology. The response variables are: attitude towards computer technology, knowledge about computer technology, and use of computer technology. The predictor factors in this study are shown in Table 1 (Pasko-Lyons, 1993).

TABLE 1

REPRESENTATION OF THE PREDICTOR FACTORS

Predictor Factors		
Gender	Age	Prior Experience
Male	20-30 years	to 5 years
Female	31-40 years	6 to 10 years
	41-50 years	11 to 20 years
	51-60 years	More than 20 years
	over 60 years	

Part I, *knowledge about computer technology,* includes questions concerning the following: (a) types of computer technology hardware (8 items); (b) software (7 items); (c) four major tasks to utilize computer technology. Part II, *use of computer technology,* includes the same 19 items as in

Part I, but focused on teachers' and principals' use of computer technology. Part III includes the same 19 items but concentrated on the teachers' and principals' *attitude toward computer technology* (Pasko-Lyons, 1993).

In Part IV, an additional 16 items measures the extent of *access to computer technology* a teacher or principal had. An additional 14 items measures the amount of *training in computer technology*. Two additional items concerned the teachers' and principals' perceptions of the *future impact* of computer technology on education. Part V consisted of three questions that provided data about the school district: extent of access to computer technology and to computer training. Part VI consisted of 10 main questions that provided data about the respondent who completed the survey. The factors included in Part VI are *gender* (male and female), *age* (20-30 years, 31-40 years, 41-50 years, 51-60 years, 60 years or more), and *prior experience* (1 to 5 years, 6 to 10 years, 11 to 20 years, and more than 20 years). Part VI also includes 17 items that measured *computer technology experience* (no experience, 1-5 years, 6-10 years, and more than 10 years.

The Pilot Study

The survey instrument with a cover letter (see appendices A and B) was distributed to 30 teachers in

Washington County, Virginia. Twenty-one of the surveys were completed and returned within the specified time limit for a return rate of 70%. A survey assessment (see Appendix C) form was included with the survey instrument asking respondents to assess the clarity and format of the instrument. Table 2 shows the results of assessment.

TABLE 2

RESULTS OF PILOT STUDY SURVEY INSTRUMENT ASSESSMENT

After completing the sample survey, please respond to the following items relative to its clarity and format.

A= Acceptable;   NI= Needs Improvement;   UA= Unacceptable

	A	NI	UA
Directions for completion	21	0	0
Format of questions	21	0	0
Clarity of wording	19	2	0
Time required for completion	19	2	0
Overall appearance of survey	21	0	0
Scoring Scales	20	1	0

The following suggestions and comments were offered by the respondents:

1.   On question number 14 include "school system."

2. Eliminate the last row of boxes in question number 9D.

3. Add a column- "would you use technology if it was available?"

4. Clarify the definition of "personally use" in questions number 2 and 4. Does "personally use" mean for personal needs or school (job-related) needs?

5. Does telecommunication include Internet?

6. Two respondents felt completion of the survey took too long (20 minutes).

7. One respondent thought the scoring scale should include a "n/a" or "don't know" heading.

Appropriate changes were made in the final survey to reflect these suggestions (see appendix A). The last row of boxes in question number 9D was eliminated as suggested. Question number 14 was changed to include "school system."

Not all suggested changes were implemented in the final instrument. The scoring scales were maintained as originally established since only one respondent thought it should be changed. The time for completion was also retained. The majority of educators evaluating the survey instrument understood that telecommunication included the Internet, so no changes were made to that question. Only one teacher suggested that a column- "would you use technology if it was available?" be added; therefore, this

change was not initiated. No other changes were made to the
final survey instrument.

Administering the Survey Instrument

Authorization to conduct the study was obtained from
each superintendent (see appendix D) of Hawkins, Sullivan,
Washington, Carter, Johnson, and Unicoi counties by return
of a postcard (see appendix E). A directory of principals
and teachers was obtained from each county superintendent.
A stratified random sample of 400 faculty members from the
total population was used to conduct this study. At least
one high school, one middle school and one elementary school
was included from each county. The survey instrument, a
cover letter explaining the purpose and importance of the
study (see appendix F) and ensuring confidentially, and a
pre-stamped envelope for the return of the survey was mailed
to the 400 participants. Two weeks after the date of the
original mailing, a postcard reminder was sent to encourage
a higher return rate (see appendix G).

Population

The population for this study included all principals
and assistant principals (approximately 145) and teachers
(approximately 2,492) in Northeast Tennessee K-12 public
schools (Hawkins, Carter, Johnson, Sullivan, Washington, and

Unicoi counties). From a total population of 2,637 educators, 400 were requested to participate in the study.

Data Analysis

To detect any differences in knowledge about technology, use of technology, and attitude toward technology, groups of respondents based on gender, groups based on age, and groups based on prior experience in education were formed. The group means on attitude toward, knowledge about, and use of technology were compared to see if they differed. Because of multiple response variables (attitude toward, knowledge about, and use of technology), the appropriate procedure for testing differences among the groups is univariate analysis of variance (ANOVA).

In general, ANOVA tests a list of response variables en masse to see if responses as a coherent body show any differences among various groups. In this study, the list of response variables are attitude toward, knowledge about, and use of technology, and the groups tested for differences differ according to gender, age, and prior educational experience.

An F-ratio statistic is provided; the greater the F, the stronger the chance of it being significant. Lastly, the ANOVA procedure produces a p-value to indicate the probability that the results could have come from a

distribution in which there were no true differences among groups (Stevens, 1986; Pdehazur, 1982). The ANOVA indicates whether or not any differences found in the group of response variables are significant. A p-value greater than .05 would indicate the null hypothesis should not be rejected. The Number Cruncher Statistical System published by Hintze (1992) was used to analyze the data.

CHAPTER 4

RESULTS

Introduction

The purpose of this study was to examine the variables apparently affecting the incorporation of computer technology in Northeast Tennessee elementary and secondary schools. The research questions presented in chapter 1 are addressed. This chapter also presents an analysis of the data to test the following null hypotheses:

Null Hypothesis (1): There is no relationship between gender and attitudes toward computer technology.

Null Hypothesis (2): There is no relationship between gender and knowledge about computer technology.

Null Hypothesis (3): There is no relationship between gender and use of computer technology.

Null Hypothesis (4): There is no relationship between age and attitudes toward computer technology.

Null Hypothesis (5): There is no relationship between age and knowledge about computer technology.

Null Hypothesis (6): There is no relationship between age and use of computer technology.

Null Hypothesis (7): There is no relationship between prior educational experience and attitudes toward computer technology.

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Null Hypothesis (8): There is no relationship between prior educational experience and knowledge about computer technology.

Null Hypothesis (9): There is no relationship between prior educational experience and use of computer technology.

Subject Demographics

Educators in Carter, Hawkins, Sullivan, Washington, Johnson, and Unicoi county school systems were involved in this study. Four hundred surveys were mailed to these educators and 208 (52%) surveys were returned. A response rate of at least 50 percent is adequate for analysis, according to Babble in Bailey (1982). Demographic characteristics of the respondents are presented in Table 3.

TABLE 3

CHARACTERISTICS OF THE RESPONDENTS

Characteristic	N	%
Gender		
Male	72	34.6
Female	136	65.4
Degree		
Bachelor's	78	37.5
Master's	115	55.3
Doctorate	7	3.4
Other	8	3.8
Age		
20-30 years	36	17.3
31-40 years	43	20.7
41-50 years	87	41.8
51-60 years	37	17.8
over 60 years	5	2.4
Experience as an Educator		
1-5 years	36	17.3
6-10 years	28	13.5
11-15 years	28	13.5
16-20 years	40	19.2
More than 20 years	76	36.5

Fifteen respondents indicated administration as their major area of emphasis in education, 17 indicated special education as their area, 90 indicated secondary, 69 indicated elementary, 9 indicated early childhood, and 8 indicated some other area of emphasis in education (see Table 4).

TABLE 4

MAJOR AREA OF EMPHASIS IN EDUCATION

FOR THE SAMPLE

Area	N	%
Early Childhood	9	4.3
Elementary	69	33.2
Secondary	90	43.3
Special Education	17	8.2
Administration	15	7.2
Other	8	3.8

Twenty-seven educators reported that they do not use computers in their major subject area, 28 reported using computers in reading, 29 in writing, 13 in thinking skills, 8 in foreign language, 23 in social studies, 22 in science, 51 in mathematics, 5 in business education, 7 in computer

courses, 5 in music, 8 in art, and 51 educators reported using computers in other subject areas (see Table 5).

TABLE 5

MAJOR SUBJECT AREA IN WHICH THE RESPONDENT

USED COMPUTER TECHNOLOGY

Subject Area	N	%
None	27	9.8
Reading	28	10.1
Writing	29	10.5
Thinking Skills	13	4.7
Foreign Language	8	2.9
Social Studies	23	8.3
Science	22	7.9
Mathematics	51	18.4
Business Education	5	1.8
Computer Courses	7	2.5
Music	5	1.8
Art	8	2.9
Other	51	18.4

The educators reported their overall level of access to computer hardware and software in their schools. Forty-one rated their level of access as excellent, 45 as good, 51 as

average, 63 as poor, 7 as none at all, and 1 as don't know
(see Table 6).

TABLE 6

OVERALL LEVEL OF ACCESS TO COMPUTER HARDWARE

AND SOFTWARE IN THEIR SCHOOLS

Level of Access	N	%
Excellent	41	19.7
Good	45	21.6
Average	51	24.5
Poor	63	30.3
None At All	7	3.4
Don't Know	1	0.5

Forty-eight percent of the educators indicated they had
1 to 5 years experience in using computers, 33% indicated 6
to 10 years experience, 15% indicated 10 years or more, and
only 4% indicated no experience. Experience in using CD-
ROMs was as follows: 65% reported 1 to 5 years, 27%
reported no experience, 8% reported 6 to 10 years
experience. Approximately one half of the respondents had
no experience using multimedia computer technology in the
classroom and about the same number reported no experience
in using telecommunications. Only 39% of the educators had

1 to 5 years experience in word processing programs. Forty-nine percent reported no experience with electronic mail and 49% also indicated no experience in using computer technology for lesson planning. Of the responding teachers and principals, 46% reported no experience using computer technology for delivery of instruction while 49% indicated they used computer technology to promote hands-on student learning (see Appendix I for survey data).

Training for and Access to Computer Technology

Question number 13 of the Teacher/Principal Technology Survey asked: To what extent does your school provide you with access to the following? This question concerns the 19 areas from computers to electronic mail shown on the survey instrument (appendix I). Sixty-nine (33%) of the respondents reported a little or no access to computers, 100 (48%) reported a little or no access to CD-ROMs, 148 (71%) a little or no access to interactive video, 138 (66%) a little or no access to videodisks, 121 (58%) a little or no access to multimedia, 94 (45%) a little or no access to word processing programs, 132 (63%) a little or no access to graphic design programs, and 130 (63%) a little or no access to electronic mail (see appendix I for additional areas). Table 7 presents responses to this question.

TABLE 7

ACCESS TO COMPUTER TECHNOLOGY

Area	None	A Little	Average	Above Average	Except.
Computers	16	53	45	47	47
CD-ROM	47	53	47	31	30
VCRs	11	15	54	68	60
Int. Video	101	47	40	15	5
Videodisks	83	55	39	18	13
Multimedia	55	66	45	28	14
Telecomm.	83	57	37	24	7
Sat. Courses	146	34	21	6	1
Word Proces.	43	51	51	36	27
Grap. Design	89	43	31	28	17
Spreadsheets	63	43	46	34	22
Grading	58	53	47	26	24
Publishing	71	64	42	18	13
Statistics	104	51	26	24	3
E Mail	74	58	36	25	15

Question number 14 asked: To what extent does your school provide you with training for the following? The areas were A. Using Technology for Lesson Planning, B. Using Technology for Delivery of Instruction, C. Using Technology for Research and D. Using Technology to Promote Hands-On Student Learning. Results are shown in Table 8.

TABLE 8

EXTENT OF COMPUTER TECHNOLOGY TRAINING

OFFERED BY SCHOOLS

Area	None	A Little	Average	Above Average	Excellent
A	114	51	30	10	3
B	96	56	39	14	3
C	110	51	33	9	5
D	79	61	46	16	6

Note. A= Using technology for lesson planning; B= Using technology for delivery of instruction; C= Using technology for research; D= Using technology to promote hands-on learning.

The majority of the respondents, over 67%, indicated that the school provided little or no training in using computer technology for lesson planning, delivery of

instruction, research, or to promote hands-on student learning.

Question number 15 on the survey asked: To what extent does your school or school system provide you with training for the following? A. Computers, B. CD-ROM, C. VCRs, D. Interactive Video, E. Videodisks, F. Multimedia, G. Telecommunications, H. Satellite Courses, I. Word Processing Programs, J. Graphic Design Programs, K. Spreadsheet Programs, L. Grading/Evaluation, M. Desktop Publishing, N. Statistical Packages and O. Electronic Mail. Respondents perceived training in these areas to be minimal. One hundred (48%) of the respondents reported training for computer use as none or little. Some other perceived deficiencies in technology training were: No training of little training in CD-ROM technology, 137 (66%); interactive video, 172 (83%); videodisks, 155 (75%); multimedia, 159 (76%); telecommunications, 163 (78%); satellite courses, 172 (83%); word processing programs, 141 (68%); graphic design programs, 160 (77%); spreadsheet programs, 144 (69%); grading and evaluation programs, 149 (72%); desktop publishing, 165 (79%); statistical packages, 175 (84%) and; electronic mail, 150 (72%). Responses are found in Table 9.

TABLE 9

EXTENT OF TECHNOLOGY TRAINING OFFERED

BY SCHOOL OR SCHOOL SYSTEM

Area	None	A Little	Average	Above Average	Except.
Computers	32	68	54	37	17
CD-ROM	81	56	40	20	11
VCRs	104	45	36	16	7
Int. Video	136	36	27	5	4
Videodisks	104	51	37	13	3
Multimedia	107	52	34	10	5
Telecomm.	113	50	25	16	4
Sat. Courses	152	30	23	3	0
Word Proces.	91	50	36	22	9
Grap. Design	120	40	34	11	3
Spreadsheets	90	54	39	21	4
Grading	94	55	36	16	7
Publishing	122	43	32	10	1
Statistics	140	35	26	6	1
E Mail	96	54	39	16	3

Question number 24 on the survey asked the educators to indicate how they received their educational technology training. Table 10 presents their responses.

TABLE 10

HOW EDUCATORS RECEIVED THEIR EDUCATIONAL

TECHNOLOGY TRAINING

Range	Self-Taught	Help From Others	Workshops	Course	Conference
0%	20	12	69	114	156
1-10%	19	63	65	61	40
11-20%	15	40	25	20	11
21-30%	29	25	16	6	3
31-40%	13	14	6	7	0
41-50%	28	21	20	8	0
51-60%	14	6	0	2	0
61-70%	19	2	0	3	0
71-80%	21	2	2	1	0
81-90%	6	1	0	0	0
100%	5	5	2	1	0

<u>Descriptive Statistics of All Response Variables</u>

The overall means and standard deviations of the
response variables, knowledge about, use of, and attitude
toward computer technology are presented in Table 11.

The composite variable, knowledge about computer
technology was determined by summing the 19 individual items
in Table 12. The following response values were used: No
Knowledge= 0, Beginner= 1, Average= 2, Above Average= 3, and
Expert= 4.

TABLE 11

OVERALL MEANS AND STANDARD DEVIATIONS

OF RESPONSE VARIABLES

<u>Response Variable</u>	<u>Mean</u>	<u>SD</u>
Knowledge About Computer Technology	1.3626	.4625
Use of Computer Technology	1.1480	.6906
Attitude Toward Computer Technology	1.8229	.6712

The means and standard deviations of the individual items
are presented in Table 12.

TABLE 12

MEANS AND STANDARD DEVIATIONS OF INDIVIDUAL ITEMS

CONCERNING KNOWLEDGE ABOUT COMPUTER TECHNOLOGY

Individual Items	M	SD
Computer	1.9471	.8410
CD-ROM	1.4615	.9623
VCRs	2.4904	.7801
Interactive Video	.8414	.9319
Videodisks	1.0144	.9902
Multimedia	1.3365	.9840
Telecommunication	1.0529	.9641
Satellite Courses	.6058	.8331
Word Processing	1.9952	1.1011
Graphic Design	1.0385	1.0208
Spreadsheets	1.2260	1.0686
Grading/Evaluation	1.5000	1.1421
Desktop Publishing	1.1538	1.1401
Statistics	.8462	.9807
Electronic Mail	1.0529	1.0866
Lesson Planning	1.5048	1.1998
Delivery of Instruction	1.5096	1.1713
Research	1.6250	1.0829
Hands-On Student Learning	1.6875	1.1092

The composite variable, level of use of computer technology was determined by summing the 19 individual items in Table 13. Response values for this variable were: Never= 0, 1-5 times per month= 1, 6-10 times per month= 2, 11-15 times per month= 3, and more than 15 times per month= 4. The means and standard deviations of the items are presented in Table 13.

TABLE 13

MEANS AND STANDARD DEVIATIONS FOR

LEVEL OF USE OF COMPUTER TECHNOLOGY

Individual Items	M	SD
Computer	2.8798	1.4039
CD-ROM	1.4519	1.4670
VCRs	2.0673	1.2608
Interactive Video	.4712	.8564
Videodisks	.4567	.8558
Multimedia	.9183	1.1623
Telecommunication	.6875	1.1478
Satellite Courses	.1058	.3912
Word Processing	2.2885	1.5239
Graphic Design	.8750	1.0604
Spreadsheets	.9086	1.1191
Grading/Evaluation	1.2740	1.3609
Desktop Publishing	.9086	1.1862
Statistics	.4183	.7505
Electronic Mail	.8221	1.3158
Lesson Planning	1.2981	1.4304
Delivery of Instruction	1.3173	1.4023
Research	1.1106	1.1723
Hands-On Student Learning	1.5529	1.5408

The third composite response variable, attitude toward computer technology, was determined by summing the 19 individual items in Table 14. The following response values were used: No Help or No Importance= 0, Helps Very Little or Little Importance= 1, Helps a Little or Average Importance= 2, Helps a Great Deal or Above Average Importance= 3, and Indispensable= 4. The means and standard deviations of this response are presented in Table 14.

TABLE 14

MEANS AND STANDARD DEVIATIONS FOR

ATTITUDE TOWARD COMPUTER TECHNOLOGY

Individual Items	M	SD
Computer	2.8750	1.1050
CD-ROM	2.0000	1.4210
VCRs	2.5817	1.2205
Interactive Video	1.1298	1.3105
Videodisks	1.1731	1.2999
Multimedia	1.5865	1.3628
Telecommunication	1.1442	1.3071
Satellite Courses	.7211	1.1160
Word Processing	2.7404	1.3866
Graphic Design	1.5769	1.3634
Spreadsheets	1.6635	1.4454
Grading/Evaluation	2.0288	1.4872
Desktop Publishing	1.5625	1.4632
Statistics	1.0577	1.2575
Electronic Mail	1.1731	1.3401
Lesson Planning	2.1490	1.1555
Delivery of Instruction	2.2836	1.1341
Research	2.5865	1.1259
Hands-On Student Learning	2.7259	1.0009

<u>Analysis of Data</u>

ANOVA on Attitude Toward, Knowledge About and Use of

Computer Technology

The response variables attitude toward, knowledge about and use of computer technology were analyzed using univariate analysis of variance (ANOVA) to determine whether or not gender, age, and prior educational experience were related to them in some way (see Table 15).

TABLE 15

RESULTS OF ANOVA ON RESPONSE VARIABLES:

ATTITUDE TOWARD, KNOWLEDGE OF, AND USE OF COMPUTER

TECHNOLOGY

Variables/<u>Predictor Factors</u>	F	P
Attitude, Gender	1.75	.1864
Attitude, Age	.75	.5562
Attitude, Experience	.96	.4293
Knowledge, Gender	.69	.4051
Knowledge, Age	3.38	.0105
Knowledge, Experience	1.41	.2308
Use, Gender	.58	.4461
Use, Age	1.58	.1820
Use, Experience	.86	.4889

Null Hypothesis (1): There is no relationship between gender and attitudes toward computer technology.

The univariate ANOVA found no significant difference of the mean attitudes toward computer technology at the alpha level of .05 due to gender (F=1.75, p=.1864). Thus, there is no relationship between gender and attitudes toward computer technology. Therefore, null hypothesis (1) failed to reject.

Null Hypothesis (2): There is no relationship between gender and knowledge about computer technology.

The univariate ANOVA found no significant difference of the mean knowledge about computer technology at the alpha level of .05 due to gender (F=.69, p= .4051). Thus, there is no relationship between gender and knowledge about computer technology. Therefore, null hypothesis (2) failed to reject.

Null Hypothesis (3): There is no relationship between gender and use of computer technology.

The univariate ANOVA found no significant difference of the mean use of computer technology at the alpha level of .05 due to gender (F=.58, p=.4461). Thus, there is no relationship between gender and use of computer technology. Therefore, null hypothesis (3) failed to reject.

Null Hypothesis (4): There is no relationship between age and attitudes toward computer technology.

The univariate ANOVA found no significant difference of the mean attitudes toward computer technology at the alpha level of .05 due to age (F=.75, p=.5562). Thus, there is no relationship between age and attitudes toward computer technology. Therefore, null hypothesis (4) failed to reject.

Null Hypothesis (5): There is no relationship between age and knowledge about computer technology.

The univariate ANOVA found a significant difference of the mean knowledge of computer technology at the alpha level of .05 due to age (F=3.38, p=.0105). Thus, there is a relationship between knowledge of computer technology and age. Null hypothesis (5) is rejected.

Null Hypothesis (6): There is no relationship between age and use of computer technology.

The univariate ANOVA found no significant difference of the mean use of computer technology at the alpha level of .05 due to age (F=1.58, p=.1820). Thus, there is no relationship between age and use of computer technology. Therefore, null hypothesis (6) failed to reject.

Null Hypothesis (7): There is no relationship between prior educational experience and attitudes toward computer technology.

The univariate ANOVA found no significant difference of the mean attitudes toward computer technology at the alpha level of .05 due to prior educational experience (F=.96,

p=.4293). Thus, there is no relationship between prior educational experience and attitudes toward computer technology. Therefore, null hypothesis (7) failed to reject.

Null Hypothesis (8): There is no relationship between prior educational experience and knowledge about computer technology.

The univariate ANOVA found no significant difference of the mean knowledge about computer technology at the alpha level of .05 due to prior educational experience (F=1.41, p=.2308). Thus, there is no relationship between prior educational experience and knowledge toward computer technology. Therefore, null hypothesis (8) failed to reject.

Null Hypothesis (9): There is no relationship between prior educational experience and use of computer technology.

The univariate ANOVA found no significant difference of the mean use of computer technology at the alpha level of .05 due to prior educational experience (F=.86, p=.4889). Thus, there is no relationship between prior educational experience and use of computer technology. Therefore, null hypothesis (9) filed to reject.

Summary

In this chapter, the relationship between gender, age, and prior educational experience and the attitude toward, knowledge of, and use of computer technology was examined. Nine null hypotheses were used to test these relationships. The data to test these null hypotheses were collected by using a survey instrument, the Teacher/Principal Technology Survey. Four hundred surveys were mailed to teachers and principals and 208 were returned for a 52% return rate. The statistical analysis of data was accomplished using the Number Cruncher Statistical System (Hintze, 1992). Analysis of data failed to reject eight of the nine null hypotheses. Null hypothesis number five, however, was rejected, thus establishing a relationship between age and knowledge of computer technology (F=3.38, p=.0105).

Demographic data concerning the respondents were also reported. Data on perceptions of the teachers and principals on the future impact of computer technology on education were also presented. Data concerning teacher and principal access to and training for computer technology were also reported.

Findings, conclusions, and recommendations of this study are reported in chapter five.

CHAPTER 5

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study was concerned with the implementation of computer technology in rural Northeast Tennessee public elementary and secondary schools. Surveys (see Appendix A) were mailed to educators in Washington, Carter, Unicoi, Johnson, Sullivan, and Hawkins county school systems. Of the 400 surveys distributed, 208 (52%) surveys were returned, from which the data for this study were collected and analyzed.

The purpose of this study was to investigate the relationship between the independent variables-gender, age, and prior education experience, and the dependent variables-attitudes toward, knowledge about, and use of computer technology among Northeast Tennessee public school teachers and principals. The relationship between these variables was investigated by testing nine null hypotheses.

Other data collected from the survey includes: demographic data of the respondents, major area of emphasis in education, major subject area in which computer technology is used, overall level of access to computer hardware and software in the school, degree of training and access to computer technology, and how educators received their computer technology training.

Findings

A breakdown of the demographic data show 35% of the respondents were male and 65% were female and 39% of the educators had bachelor's degrees, 58% held master's degrees, and 3% had doctoral degrees. A majority (60%) of the respondents reported their age to be between 41 to 60 years. Over a third (37%) of the teachers and principals indicated more than 20 years of prior educational experience. The two major areas of emphasis in education for the respondents were: elementary--33% and secondary--43%. The major subject area in which computer technology was most often used was mathematics, 18.4%; the response, "other," was also 18.4%. The overall level of access to computer hardware and software in the respondent's respective school was reported to be excellent by 19.7% of the educators. Approximately 20% reported their level of access as good, 24.5% as average, 30.3% as poor, and 3.4% as none at all.

Part of the survey instrument concerned the level of access to training for and access to computer technology. Thirty-three percent of the respondents indicated they had little or no access to computers and computer training. The majority of the educators (over 67%) reported that the school provided little or no training in using computer technology for lesson planning, delivery of instruction, research, or to promote hands-on student learning. The respondents also indicated that most of their computer

training was learned informally from others or through self-teaching.

In addition to the above data, information concerning the respondent's perceptions of the future impact of computer technology on education was elicited in Part IV of the survey. The educators were asked the following question concerning the fourteen types of technology: In your work as a teacher/principal, to what extent do you believe that access to the following would help you? Response categories for each item were as follows: 0 (No Help), 1 (Would Help Very Little), 2 (Would Help a Little), 3 (Would Help a Great Deal), and 4 (Indispensable). Access to computers was reported as extremely helpful; 178 of the respondents (86%) rated access as category 3 or category 4.

Question number thirteen on the survey asked: Five years from now, what impact will technology have on you personally as a teacher/principal in the school? There was a definite tendency for the educators to respond "indispensable" or "would help a great deal" (frequency = 172, 83%).

The next question on the survey asked: Five years from now, what impact will technology have on teachers/principals overall in the schools? The tendency to respond "indispensable" or "would help a great deal" (frequency = 185, 88%) was even greater on this question.

Appendix J shows the frequency of response to the above questions.

Research Questions

1. Do male and female teachers and principals report similar attitudes toward computer technology, knowledge about computer technology, and the use of computer technology?

2. Do teachers and principals of different ages report similar attitudes toward computer technology, knowledge about computer technology, and the use of computer technology?

3. Do teachers and principals with different levels of prior educational work experiences report similar attitudes toward computer technology, knowledge about computer technology, and use of computer technology?

This study showed that there were no significant differences in male educators' and female educators' attitudes toward computer technology, knowledge about computer technology, and use of computer technology. Teachers and principals of different ages reported similar attitudes toward and use of computer technology, but educators of different ages did not report similar knowledge about computer technology. Teachers and principals with different levels of prior educational work experiences

reported similar attitudes toward computer technology, knowledge about computer technology, and use of computer technology.

Conclusions

The conclusions from this study pertain to rural public school teachers and administrators in Washington, Hawkins, Johnson, Sullivan, Carter, and Unicoi county school systems in Tennessee.

Based on the data gathered and analyzed from the Teacher/Principal Technology Survey, the following conclusions are presented.

Conclusion Number One

The overall level of access to computer hardware and software in individual schools is not adequate if computer technology is to become a substantial part of students' learning.

Conclusion Number Two

Schools are perceived by respondents as providing little or no teacher training in using computer technology for lesson planning, delivery of instruction, research, or to promote hands-on student learning.

Conclusion Number Three

Teachers and administrators believe that computer technology would be extremely helpful in their work now.

Conclusion Number Four

Teachers and administrators believe that computer technology will be almost indispensable in schools in the near future.

Conclusion Number Five

Male and female educators report similar attitudes toward, knowledge about, and use of computer technology.

Conclusion Number Six

Educators of different ages report similar attitudes toward and use of computer technology. Educators of different ages, however, do not report similar knowledge of computer technology. Since many of the respondents were over age 41 (N= 129, 62%), it may be that they did not have similar knowledge as other age groups because they did not receive computer training during their college education.

Conclusion Number Seven

Teachers and principals with different levels of prior education experiences report similar attitudes toward, knowledge about, and use of computer technology.

Conclusion Number Eight

In planning future computer training programs, it is probably not necessary to differentiate groups according to personal attributes such as gender, age, and prior experience.

Conclusion Number Nine

The potential for the instructional use of computer technology has not yet been realized. Eagan High School in Minnesota, a National Blue Ribbon School, was recently designated as a national exemplary technology school by the U.S. Department of Education. Thomas F. Wilson (1996/1997), principal of the school, believes that if the use of computer technology is going to reach its potential in schools, the principal must become a technology leader. He or she must seek a variety of funding sources including parent fund raising, school business partnerships, grants, and district offices. The principal must identify pools of technology talent within his or her faculty and use these teachers to lead their peers into the technology challenge.

Recommendations

The following recommendations are presented from this study.

Recommendation Number One

There should be enough computer technology available in all schools for teachers and principals to have unrestricted access.

Recommendation Number Two

There should be sufficient and adequate computer

technology training for teachers and principals offered at the local level at convenient times. The availability of this training should be clearly communicated to all educators with release time provided to take the training.

Recommendation Number Three

There should be adequate support and time for teachers and principals to learn how to use technology and plan for use in the school setting.

Recommendation Number Four

This study should be expanded and replicated to include a larger sample size of educators from across the state of Tennessee.

Recommendation Number Five

The relationship between age and knowledge of computer technology should be further investigated.

Recommendation Number Six

Teachers and principals who are proficient in computer technology should serve as role models and peer tutors for those who want to learn how to use computer technology.

Recommendation Number Seven

District and building administrators should provide computer technology training and planning during the school day. Educators should be released from their usual teaching schedule to take advantage of technology training.

Recommendation Number Eight

County and local school administrators should seek partnerships with industry to get and maintain computer equipment.

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APPENDICES

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APPENDIX A

Teacher/Principal Technology Survey

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Teacher/Principal Technology Survey

Investigator: Carl Steven Rapp
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This survey is being sent to teachers/principals in Hawkins, Johnson, Washington, Carter, Unicoi, and Sullivan Counties. In order for this survey to accurately represent the status of the knowledge about, use of and attitude toward computer technology in Northeast Tennessee Public Schools, it is necessary that a statistically high proportion complete and return the questionnaire. Completion of the survey should take approximately 10-20 minutes. Please answer promptly and return the survey in the prestamped, preaddressed envelope by December 16, 1996.

Your time and thoughtful consideration will be greatly appreciated.

Thank You!

Instructions

To answer each question that includes a grid, please check only one box in each row of the grid. To answer all other questions, please check only one box.

Part I - Level of Knowledge

1. What is your level of KNOWLEDGE of the following types of technology?

	No Knowledge	Beginner	Average	Above Average	Expert
A. Computers	☐	☐	☐	☐	☐
B. CD-ROM	☐	☐	☐	☐	☐
C. VCRs	☐	☐	☐	☐	☐
D. Interactive Video	☐	☐	☐	☐	☐
E. Videodisks	☐	☐	☐	☐	☐
F. Multimedia	☐	☐	☐	☐	☐
G. Telecommunicate	☐	☐	☐	☐	☐
H. Satellite Courses	☐	☐	☐	☐	☐

Part II - Level of Use

2. As a teacher/principal, to what extent do you personally USE the following types of technology?

	Never	1-5 times per month	6-10 times per month	11-15 times per month	More than 15 times/ month
A. Computers	☐	☐	☐	☐	☐
B. CD-ROM	☐	☐	☐	☐	☐
C. VCRs	☐	☐	☐	☐	☐
D. Interactive Video	☐	☐	☐	☐	☐
E. Videodisks	☐	☐	☐	☐	☐
F. Multimedia	☐	☐	☐	☐	☐
G. Telecommunicate	☐	☐	☐	☐	☐
H. Satellite Courses	☐	☐	☐	☐	☐

3. What is your level of KNOWLEDGE of the following types of software?

	No Knowledge	Beginner	Average	Above Average	Expert
A. Word Processing	☐	☐	☐	☐	☐
B. Graphic Design	☐	☐	☐	☐	☐
C. Spreadsheets	☐	☐	☐	☐	☐
D. Grading/Evaluation	☐	☐	☐	☐	☐
E. Desktop Publishing	☐	☐	☐	☐	☐
F. Statistics	☐	☐	☐	☐	☐
G. Electronic Mail	☐	☐	☐	☐	☐

4. As a teacher/prinicpal, to what extent do you personally USE the following software?

	Never	1-5 times per month	6-10 times per month	11-15 times per month	More than 15 times/ month
A. Word Processing	☐	☐	☐	☐	☐
B. Graphic Design	☐	☐	☐	☐	☐
C. Spreadsheets	☐	☐	☐	☐	☐
D. Grading/Evaluation	☐	☐	☐	☐	☐
E. Desktop Publishing	☐	☐	☐	☐	☐
F. Statistics	☐	☐	☐	☐	☐
G. Electronic Mail	☐	☐	☐	☐	☐

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5. What is your level of KNOWLEDGE using technology for the following educational tasks?

	No Knowledge	Beginner	Average	Above Average	Expert
A. Lesson planning	□	□	□	□	□
B. Delivery of Instr.	□	□	□	□	□
C. Research	□	□	□	□	□
D. Promote Hands-On Student Learning	□	□	□	□	□

6. As a teacher/principal, to what extent do you personally USE technology for the following educational tasks?

	Never	1-5 times per month	6-10 times per month	11-15 times per month	More than 15 times/ month
A. Lesson planning	□	□	□	□	□
B. Delivery of Instr.	□	□	□	□	□
C. Research	□	□	□	□	□
D. Promote Hands-On Student Learning	□	□	□	□	□

Part III - Level of Attitude Toward Technology

7. As a teacher/principal, to what extent do your BELIEVE the following TYPES OF TECHNOLOGY help you personally in your work?

	No Help	Helps Very Little	Helps A Little	Helps A Great Deal	Indispensable
A. Computers	□	□	□	□	□
B. CD-ROM	□	□	□	□	□
C. VCRs	□	□	□	□	□
D. Interactive Video	□	□	□	□	□
E. Videodisks	□	□	□	□	□
F. Multimedia	□	□	□	□	□
G. Telecommunication	□	□	□	□	□
H. Satellite Courses	□	□	□	□	□

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8. As a teacher/principal, to what extent do you BELIEVE the following types of SOFTWARE programs help you personally in your work?

	No Help	Helps Very Little	Helps A Little	Helps A Great Deal	Indispensable
A. Word Processing	☐	☐	☐	☐	☐
B. Graphic Design	☐	☐	☐	☐	☐
C. Spreadsheets	☐	☐	☐	☐	☐
D. Grading/Evaluation	☐	☐	☐	☐	☐
E. Desktop Publishing	☐	☐	☐	☐	☐
F. Statistics	☐	☐	☐	☐	☐
G. Electronic Mail	☐	☐	☐	☐	☐

9. As a teacher/principal, to what extent do you BELIEVE technology is important for these educational tasks?

	No Importance	Little Importance	Average Importance	Above Average Importance	Indispensable
A. Lesson Planning	☐	☐	☐	☐	☐
B. Delivery of Instr.	☐	☐	☐	☐	☐
C. Research	☐	☐	☐	☐	☐
D. Promote Hands-On Student Learning	☐	☐	☐	☐	☐

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Part IV - Perceptions of the Future Impact of Technology

10. In your work as a teacher/principal, to what extent do you BELIEVE THAT ACCESS to the following would help you?

	No Help	Would Help Very Little	Would Help A Little	Would Help A Great Deal	Indispensable
A. Computers	□	□	□	□	□
B. CD-ROM	□	□	□	□	□
C. VCRs	□	□	□	□	□
D. Interactive Video	□	□	□	□	□
E. Videodisks	□	□	□	□	□
G. Telecommunications	□	□	□	□	□
H. Satellite Courses	□	□	□	□	□
I. Word Processing Programs	□	□	□	□	□
J. Graphic Design Programs	□	□	□	□	□
K. Spreadsheet Programs	□	□	□	□	□
L. Grading/Evaluation Programs	□	□	□	□	□
M. Desktop Publishing	□	□	□	□	□
N. Statistical Packages	□	□	□	□	□
O. Electronic Mail	□	□	□	□	□

11. Five years from now, what impact will technology have on you personally as a teacher/principal in the school?

Indispensable	□
Will Help A Great Deal	□
Will Help A Little	□
Will Help Very Little	□
No Help	□

12. Five years from now, what impact will technology have on teachers/principals overall in the schools?

Indispensable	□
Will Help A Great Deal	□
Will Help A Little	□
Will Help Very Little	□
No Help	□

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Part V - Descriptive Data About Your School

13. To what extent does your school provide you ACCESS to the following?

	None	A Little	Average	Above Average	Exceptional
A. Computers	☐	☐	☐	☐	☐
B. CD-ROM	☐	☐	☐	☐	☐
C. VCRs	☐	☐	☐	☐	☐
D. Interactive Video	☐	☐	☐	☐	☐
E. Videodisks	☐	☐	☐	☐	☐
F. Multimedia	☐	☐	☐	☐	☐
G. Telecommeunications	☐	☐	☐	☐	☐
H. Satellite Course	☐	☐	☐	☐	☐
I. Word Processing Programs	☐	☐	☐	☐	☐
J. Graphic Design Programs	☐	☐	☐	☐	☐
K. Spreadsheet Programs	☐	☐	☐	☐	☐
L. Grading/Evaluation Programs	☐	☐	☐	☐	☐
M. Desktop Publishing	☐	☐	☐	☐	☐
N. Statistical Packages	☐	☐	☐	☐	☐
O. Electronic Mail	☐	☐	☐	☐	☐

14. To what extent does your school provide you with TRAINING for the following?

	None	A Little	Average	Above Average	Exceptional
A. Using Technology for Lesson Planning	☐	☐	☐	☐	☐
B. Using Technology for Delivery of Instr.	☐	☐	☐	☐	☐
C. Using Technology for Research	☐	☐	☐	☐	☐
D. Using Technology to Promote Hands-On Student Learning	☐	☐	☐	☐	☐

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15. To what extent does your school or school system provide you with TRAINING for the following?	None	A Little	Average	Above Average	Exceptional
A. Computers	☐	☐	☐	☐	☐
B. CD-ROM	☐	☐	☐	☐	☐
C. VCRs	☐	☐	☐	☐	☐
D. Interactive Video	☐	☐	☐	☐	☐
E. Videodisks	☐	☐	☐	☐	☐
F. Multimedia	☐	☐	☐	☐	☐
G. Telecommunications	☐	☐	☐	☐	☐
H. Satellite Courses	☐	☐	☐	☐	☐
I. Word Processing Programs	☐	☐	☐	☐	☐
J. Graphic Design Programs	☐	☐	☐	☐	☐
K. Spreadsheet Programs	☐	☐	☐	☐	☐
L. Grading/Evaluative Programs	☐	☐	☐	☐	☐
M. Desktop Publishing	☐	☐	☐	☐	☐
N. Statistical Packages	☐	☐	☐	☐	☐
O. Electronic Mail	☐	☐	☐	☐	☐

Part VI - Descriptive Data About Yourself

Please check one box for each question

16. What is your status?

Full time	☐
Part time	☐

19. What is your highest degree earned?

Bachelor's	☐
Master's	☐
Doctorate	☐

17. What is your present age?

20-30	☐
31-40	☐
41-50	☐
51-60	☐
Over 60	☐

18. Are you male or female?

Male	☐
Female	☐

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Part VI - Descriptive Data About Yourself (Continued)

20. How many years of experience do you have working in education?

1-5	☐
6-10	☐
11-15	☐
16-20	☐
More than 20	☐

21. Presently, what is your major area of emphasis in education (indicate only one)?

Curriculum	☐
Early Childhood	☐
Elementary	☐
Secondary	☐
Special Education	☐
Administration	☐
Other	☐

22. Presently, what is your major subject area in which you use computer technology?

None	☐
Reading	☐
Writing	☐
Thinking Skills	☐
Foreign Language	☐
Social Studies	☐
Science	☐
Mathematics	☐
Business Education	☐
Computer Courses	☐
Music	☐
Art	☐
Other	☐

23. Overall, what would you rate your level of access to computer hardware and software in your school?

Excellent	☐
Good	☐
Average	☐
Poor	☐
None At All	☐
Don't Know	☐

24. Indicate the percent of your educational technology training that you receive through each of the following means: (Please make sure your percentages total 100%).

_____	Self-Taught
_____	Help From Others
_____	Workshops
_____	Courses
_____	Conferences
_____	Other:_____
100%	

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Part VI - Descriptive Data About Yourself (Continued)

25. Indicate total years of experience with each of the following (check only one box for each item).

	No Experience	1-5 Years	6-10 Years	More Than 10 Years
A. Computers	☐	☐	☐	☐
B. CD-ROM	☐	☐	☐	☐
C. VCRs	☐	☐	☐	☐
D. Interactive Video	☐	☐	☐	☐
E. Multimedia	☐	☐	☐	☐
G. Telecommunications	☐	☐	☐	☐
H. Satellite Courses	☐	☐	☐	☐
I. Word Processing Programs	☐	☐	☐	☐
J. Graphic Design Programs	☐	☐	☐	☐
K. Spreadsheet Programs	☐	☐	☐	☐
L. Grading/Evaluation Programs	☐	☐	☐	☐
M. Desktop Publishing	☐	☐	☐	☐
N. Statistical Packages	☐	☐	☐	☐
O. Electronic Mail	☐	☐	☐	☐
P. Using Technology for Lesson Planning	☐	☐	☐	☐
Q. Using Techcnology for Delivery of Instruction	☐	☐	☐	☐
R. Using Technology to Promote Hands-On Student Learning	☐	☐	☐	☐

Thank you for completing this survey.

Please return in the enclosed envelope to :

Carl Steven Rapp
18615 Cleveland Road
Abingdon, VA 24211

APPENDIX B

Pilot Study Letter

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October 10, 1996

Dear Teacher/Administrator,

I teach chemistry, physics, and astronomy at University School in Johnson City, Tennessee and am currently a doctoral student at East Tennessee State University in the Department of Educational Leadership and Policy Analysis. I am preparing to investigate the factors affecting the implementation of technology in Northeast Tennessee K-12 public schools. I am developing a survey instrument that consists of three parts. Part I concerns the level of knowledge of technology, part II seeks information about the level of use of technology, and part III concerns prevailing attitudes toward technology.

As a fellow educator and colleague I need your assistance. I am seeking the opinion and advice from selected individuals on the survey instrument. Would you please complete the enclosed survey and the assessment form to help me clarify and improve the instrument? Please read the survey instrument and instructions fully, respond to it, and then complete the assessment form.

Your comments or suggestions for improvement, clarity, or format are requested to help make the final survey more useful. Your assistance with this important development process is greatly appreciated.

I want to assure you that neither you nor your school will be identified individually in any way during my study. The summary of the results of this survey will be made available to the Tennessee State Department of Technology Education.

Please respond in a timely fashion so that your suggestions can be included in the development of the final survey. Please return the completed survey and the assessment form by October 25, 1996 in the self-addressed, stamped envelope which has been included for your convenience.

Thank you in advance for your time and consideration.

Sincerely,

Steve Rapp
ETSU Doctoral Candidate
18615 Cleveland Road
Abingdon, VA 24211

APPENDIX C

Pilot Study Assessment Instrument

133

Survey Instrument Assessment

After completing the sample survey, please respond to the following items relative to its clarity and format.

A= Acceptable; NI= Needs Improvement; UA= Unacceptable

1._____ Directions for completion

2._____ Format of questions

3._____ Clarity of wording

4._____ Time required for completion

5._____ Overall appearance of survey

6._____ Scoring Scales

Are there any questions which should be changed or reworded? Please list number(s)_____

_____

Are there any questions which should be eliminated? Please list number(s).

_____

_____

Are there any question which should be added? Please list topics. _____

_____

_____

Additional comments._____

_____

_____

_____

Thank you for your time and consideration.

APPENDIX D

Letter to Superintendents Seeking Permission

to Conduct Study

135

Carl Steven Rapp
18615 Cleveland Road
Abingdon, VA 24211
540-676-3896
October 28, 1996

«Mr./Mrs./Ms.» «First Name» «Last Name»
«Address Line 2»
«City» «State» «Postal Code»

Dear «Mr./Mrs./Ms.» «Last Name»:

I teach chemistry, physics, and astronomy at University School in Johnson City, Tennessee and am currently a doctoral student at East Tennessee State University in the Department of Educational Leadership and Policy Analysis. I am preparing to investigate the factors affecting the incorporation of computer technology in Northeast Tennessee public elementary and secondary schools. I have developed a survey instrument that consists of three parts. Part I concerns the level of knowledge of technology, part II seeks information about the level of use of technology, and part III concerns prevailing attitudes toward technology. I plan to survey about 400 teachers and principals in Hawkins, Sullivan, Washington, Carter, Unicoi, and Johnson counties. I have enclosed a copy of the survey for your convenience.

I need your assistance with this study. Will you please allow the teachers and principals in your county to participate in the study? Please return the enclosed postcard by November 11, 1996.

The survey will take about 10-20 minutes to complete. Results of the study will be confidential. Prepaid postage for the return of the survey will be provided.

For your participation in the study, I will provide you a summary report of the results.

Thank you in advance for your help and cooperation with this investigation.

Sincerely,

Carl S. Rapp

APPENDIX E

Postcard Granting Permission to Conduct Study

137

«Mr./Mrs./Ms.» «First Name» «Last Name»:

Please complete this postcard and return it to me. For your convenience, postage is provided.

YES, I agree to allow my faculty to participate in the Teacher/Principal Technology Survey.

Superintendent's Signature_____

Please return by November 11, 1996.

Sincerely,

Carl Steven Rapp, ETSU Doctoral Candidate
East Tennessee State University

APPENDIX F

Letter to Teachers and Principals

139

November 20, 1996

Dear <First Name>,

I teach chemistry, physics, and astronomy at University School in Johnson City, Tennessee and am currently a doctoral student at East Tennessee State University in the Department of Educational Leadership and Policy Analysis. As part of my dissertation, I am preparing to investigate the factors affecting the implementation of technology in Northeast Tennessee K-12 public schools. I have developed a survey instrument that consists of three parts. Part I concerns the level of knowledge of technology, part II seeks information about the level of use of technology, and part III concerns prevailing attitudes toward technology.

As a fellow educator and colleague I need your assistance. Would you please complete the enclosed survey and return it to me as soon as possible in the enclosed postage-paid envelope. Completion of the survey should only require about 10-20 minutes of your time.

I want to assure you that neither you nor your school will be identified individually in any way during my study. The summary of the results of this survey will be made available to the Tennessee State Department of Technology Education.

If you have any questions, please contact me at (423) 439-6352 or RappS@Ten-Nash.Ten.K12.TN.US.

Thank you in advance for your time and consideration.

Sincerely,

Carl Steven Rapp
ETSU Doctoral Candidate
18615 Cleveland Road
Abingdon, VA 24211

APPENDIX G

Postcard Reminder to Return Survey

141

Dear Colleague,

About 2 weeks ago you received a Teacher/Principal Technology
Survey. I have not received your completed survey. Would you
please complete it and return it to me as soon as possible. You
are very important to this study. Thank you in advance for your
prompt response.

Sincerely,

Carl Steven Rapp
ETSU Doctoral Candidate

APPENDIX H

Request to Modify and Use Questionnaire

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Carl S. Rapp

18615 Cleveland Road
Abingdon, VA 24211

Telephone (540) 676-3896

January 24, 1996

Dr. Veronical J. Pasko-Lyons
4665 East Quartz Mountain Road
Paradise Valley, Arizona 85253

Dear Dr. Lyons,

I am a Doctoral student, at East Tennessee State University, Johnson City, Tennessee, planning a study similar to the excellent study you conducted for your dissertation at The University of Pennsylvania. I was most impressed with your thorough study and I thought the survey was particularly well done.

I am requesting your permission to modify and use your survey in my investigation. My dissertation concerns the use of technology in Northeast Tennessee Public Schools; some of your questions would be modified and others would not be used at all.

I am hopeful that you can grant me written permission to modify and use your survey in my study. Thank you in advance for your consideration and help.

Sincerely,

Carl S. Rapp

APPENDIX I

Letter Granting Permission to Modify and Use Survey

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Veronica J. Pasko-Lyons, Ph.D.

4665 E. Quartz Mountain Road
Paradise Valley. Arizona 85253
(602) 840-1429

February 10, 1996
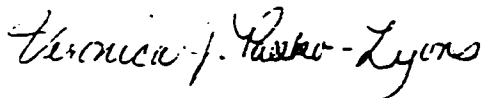
Carl S. Rapp
18615 Cleveland Road
Abington, VA 24211

Dear Carl:

You have my permission to modify and use my survey in your investigation. I would only request that you send a copy of the modified survey and also a synopsis of your final results to me upon completion.

Good luck !

Sincerely,

Veronica J. Pasko-Lyons, Ph. D.

APPENDIX J

Survey Results

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Instructions

To answer each question that includes a grid, please check only one box in each row of the grid. To answer all other questions, please check only one box.

Part I - Level of Knowledge

1. What is your level of KNOWLEDGE of the following types of technology?

	No Knowledge	Beginner	Average	Above Average	Expert
A. Computers	5	63	90	46	4
B. CD-ROM	38	65	67	37	1
C. VCRs	3	11	89	89	16
D. Interactive Video	96	59	44	7	2
E. Videodiscs	81	62	49	14	2
F. Multimedia	50	67	65	25	1
G. Telecommunicate	73	67	52	15	1
H. Satellite Courses	120	55	26	7	0

3. What is your level of KNOWLEDGE of the following types of software?

	No Knowledge	Beginner	Average	Above Average	Expert
A. Word Processing	27	40	65	65	11
B. Graphic Design	80	62	44	20	2
C. Spreadsheets	69	61	51	23	4
D. Grading/Evaluation	51	59	56	34	8
E. Desktop Publishing	83	49	47	24	5
F. Statistics	104	50	40	13	1
G. Electronic Mail	87	56	42	19	4

Part II - Level of Use

2. As a teacher/principal, to what extent do you personally USE the following types of technology?

	Never	1-5 times per month	6-10 times per month	11-15 times per month	More than 15 times/ month
A. Computers	19	35	26	22	106
B. CD-ROM	66	60	22	26	34
C. VCRs	14	73	46	30	45
D. Interactive Video	148	37	17	4	2
E. Videodiscs	143	45	8	4	8
F. Multimedia	107	48	29	14	10
G. Telecommunicate	136	45	8	10	9
H. Satellite Courses	193	12	2	1	0

4. As a teacher/prinicpal, to what extent do you personally USE the following software?

	Never	1-5 times per month	6-10 times per month	11-15 times per month	More than 15 times/ month
A. Word Processing	39	44	28	30	67
B. Graphic Design	98	64	27	11	8
C. Spreadsheets	96	67	23	10	12
D. Grading/Evaluation	85	56	28	13	26
E. Desktop Publishing	114	46	24	10	14
F. Statistics	150	39	13	4	2
G. Electronic Mail	133	37	8	10	20

5. What is your level of KNOWLEDGE using technology for the following educational tasks?						6. As a teacher/principal, to what extent do you personally USE technology for the following educational tasks?				
	No Knowledge	Beginner	Average	Above Average	Expert	Never	1-5 times per month	6-10 times per month	11-15 times per month	More than 15 times/ month
A. Lesson planning	59	42	62	35	10	87	51	24	16	30
B. Delivery of Instr.	56	48	61	34	9	83	52	33	12	28
C. Research	38	56	68	39	7	75	79	28	10	16
D. Promote Hands-On Student Learning	36	53	69	41	9	74	52	24	18	40

Part III - Level of Attitude Toward Technology

7. As a teacher/principal, to what extent do your BELIEVE the following TYPES OF TECHNOLOGY help you personally in your work?

	No Help	Helps Very Little	Helps A Little	Helps A Great Deal	Indispensable
A. Computers	12	10	34	86	66
B. CD-ROM	56	19	35	70	28
C. VCRs	19	14	41	95	39
D. Interactive Video	108	23	32	38	7
E. Videodiscs	101	28	30	41	8
F. Multimedia	73	22	44	55	14
G. Telecommunication	106	26	29	39	8
H. Satellite Courses	138	22	21	25	2

8. As a teacher/principal, to what extent do you BELIEVE the following types of SOFTWARE programs help you personally in your work?

	No Help	Helps Very Little	Helps A Little	Helps A Great Deal	Indispensable
A. Word Processing	31	21	14	76	66
B. Graphic Design	73	28	41	51	15
C. Spreadsheets	70	23	40	51	24
D. Grading/Evaluation	58	22	31	56	41
E. Desktop Publishing	80	25	30	51	22
F. Statistics	118	35	15	34	6
G. Electronic Mail	97	32	31	34	14

9. As a teacher/principal, to what extent do you BELIEVE technology is important for these educational tasks?

	No Importance	Little Importance	Average Importance	Above Average Importance	Indispensable
A. Lesson Planning	19	36	61	67	25
B. Delivery of Instr.	17	27	60	73	31
C. Research	16	14	53	83	42
D. Promote Hands-On Student Learning	11	8	55	89	45

Part IV - Perceptions of the Future Impact of Technology

10. In your work as a teacher/principal, to what extent do you BELIEVE THAT ACCESS to the following would help you?

	No Help	Would Help Very Little	Would Help A Little	Would Help A Great Deal	Indispensable
A. Computers	6	3	20	98	80
B. CD-ROM	9	10	35	81	73
C. VCRs	5	7	32	102	62
D. Interactive Video	22	21	45	89	31
E. Videodiscs	15	20	47	91	35
G. Telecommunications	16	27	50	85	30
H. Satellite Courses	33	29	54	66	26
I. Word Processing Programs	11	10	32	101	54
J. Graphic Design Programs	19	25	46	89	29
K. Spreadsheet Programs	25	25	46	76	36
L. Grading/Evaluation Programs	11	12	43	92	50
M. Desktop Publishing	20	25	47	86	30
N. Statistical Packages	33	38	49	68	20
O. Electronic Mail	24	30	54	63	37

11. Five years from now, what impact will technology have on you personally as a teacher/principal in the school?	
Indispensable	76
Will Help A Great Deal	96
Will Help A Little	27
Will Help Very Little	5
No Help	4

12. Five years from now, what impact will technology have on teachers/principals overall in the schools?	
Indispensable	76
Will Help A Great Deal	109
Will Help A Little	17
Will Help Very Little	4
No Help	2

Part V - Descriptive Data About Your School

> **13. To what extent does your school provide you ACCESS to the following?**

	None	A Little	Average	Above Average	Exceptional
A. Computers	16	53	45	47	47
B. CD-ROM	47	53	47	31	30
C. VCRs	11	15	54	68	60
D. Interactive Video	101	47	40	15	5
E. Videodiscs	83	55	39	18	13
F. Multimedia	55	66	45	28	14
G. Telecommeunications	83	57	37	24	7
H. Satellite Course	146	34	21	6	1
I. Word Processing Programs	43	51	51	36	27
J. Graphic Design Programs	89	43	31	28	17
K. Spreadsheet Programs	63	43	46	34	22
L. Grading/Evaluation Programs	58	53	47	26	24
M. Desktop Publishing	71	64	42	18	13
N. Statistical Packages	104	51	26	24	3
O. Electronic Mail	74	58	36	25	15

> **14. To what extent doe your school provide you with TRAINING for the following?**

	None	A Little	Average	Above Average	Exceptional
A. Using Technology for Lesson Planning	114	51	30	10	3
B. Using Technology for Delivery of Instr.	96	56	39	14	3
C. Using Technology for Research	110	51	33	9	5
D. Using Technology to Promote Hands-On Student Learning	79	61	46	16	6

15. To what extent does your school or school system provide you with TRAINING for the following?

	None	A Little	Average	Above Average	Exceptional
A. Computers	32	68	54	37	17
B. CD-ROM	81	56	40	20	11
C. VCRs	104	45	36	16	7
D. Interactive Video	136	36	27	5	4
E. Videodiscs	104	51	37	13	3
F. Multimedia	107	52	34	10	5
G. Telecommunications	113	50	25	16	4
H. Satellite Courses	152	30	23	3	0
I. Word Processing Programs	91	50	36	22	9
J. Graphic Design Programs	120	40	34	11	3
K. Spreadsheet Programs	90	54	39	21	4
L. Grading/Evaluative Programs	94	55	36	16	7
M. Desktop Publishing	122	43	32	10	1
N. Statistical Packages	140	35	26	6	1
O. Electronic Mail	96	54	39	16	3

Part VI - Descriptive Data About Yourself

Please check one box for each question

16. What is your status?

Full time	205
Part time	3

19. What is your highest degree earned?

Bachelor's	78
Master's	115
Doctorate	7

17. What is your present age?

20-30	36
31-40	43
41-50	87
51-60	37
Over 60	5

18. Are you male or female?

Male	70
Female	138

Part VI - Descriptive Data About Yourself (Continued)

20. How many years of experience do you have working in education?

1-5	36
6-10	28
11-15	28
16-20	40
More than 20	76

21. Presently, what is your major area of emphasis in education (indicate only one)?

Curriculum	0
Early Childhood	9
Elementary	69
Secondary	90
Special Education	17
Administration	15
Other	8

22. Presently, what is your major subject area in which you use computer technology?

None	27
Reading	28
Writing	29
Thinking Skills	13
Foreign Language	8
Social Studies	23
Science	22
Mathematics	51
Business Education	5
Computer Courses	7
Music	5
Art	8
Other	51

23. Overall, what would you rate your level of access to computer hardware and software in your school?

Excellent	41
Good	45
Average	51
Poor	63
None At All	7
Don't Know	1

24. Indicate the percent of your educational technology training that you receive through each of the following means: (Please make sure your percentages total 100%).

	Self-Taught
	Help From Others
	Workshops
	Courses
	Conferences
_____	Other:_____
100%	

Part VI - Descriptive Data About Yourself (Continued)

25. Indicate total years of experience with each of the following (check only one box for each item).

	No Experience	1-5 Years	6-10 Years	More Than 10 Years
A. Computers	9	99	69	31
B. CD-ROM	56	135	16	1
C. VCRs	10	15	69	114
D. Interactive Video	125	75	6	2
E. Multimedia	101	72	20	15
G. Telecommunications	118	75	8	7
H. Satellite Courses	161	34	8	5
I. Word Processing Programs	48	81	54	25
J. Graphic Design Programs	102	77	23	6
K. Spreadsheet Programs	87	81	28	12
L. Grading/Evaluation Programs	71	96	33	8
M. Desktop Publishing	103	78	22	5
N. Statistical Packages	143	56	7	2
O. Electronic Mail	101	97	8	2
P. Using Technology for Lesson Planning	101	90	12	5
Q. Using Technology for Delivery of Instruction	95	90	14	9
R. Using Technology to Promote Hands-On Student Learning	74	101	21	12

Thank you for completing this survey.

Please return in the enclosed envelope to :

Carl Steven Rapp
18615 Cleveland Road
Abingdon, VA 24211

Survey Question Number 24

	Self-Taught	Help from Others	Workshops	Courses	Conferences	Other
0%	20	12	69	114	156	204
1%-10%	19	63	65	61	40	4
11%-20%	15	40	25	20	11	0
21%-30%	29	39	16	6	3	0
31%-40%	13	14	6	7	0	0
41%-50%	28	21	20	8	0	0
51%-60%	14	6	0	2	0	0
61%-70%	19	2	0	3	0	0
71%-80%	21	2	2	1	0	0
81%-90%	19	1	0	0	0	0
91%-99%	6	1	0	0	0	0
100%	5	5	2	1	0	1

VITA

CARL STEVEN RAPP

Personal Data:

Date of Birth: November 1, 1947
Place of Birth: Raysal, West Virginia
Marital Status: Married

Education:

Public Schools, Iaeger, West Virginia

Concord College, Athens, West Virginia; Biology and Science Education, B.S., 1969

Marshall University, Huntington, West Virginia; Secondary Administration, M.S., 1973

Marshall University, Huntington, West Virginia; Physical Science, M.A., 1989

East Tennessee State University, Johnson City, Tennessee; Administration, Ed.D., 1997

Professsional Experience:

Teacher, Iaeger Intermediate, Iaeger, West Virginia, 1969-1973

Teacher, Iaeger High School, Iaeger, West Virginia, 1973-1989

Teacher, University School, Johnson City, Tennessee, 1989-present

Publications:

Rapp, Carl S., "Getting close with the scanning tunneling electron microscope," accepted for publication in Journal of Chemical Education, April, 1997.

Rapp, Carl S. (1997, March). "Laser Holography," The Science Teacher, 4(3), pp. 38-42.

Rapp, Carl S. (1993, April). "Lasers and refraction," The Science Teacher, 60 (4), pp. 50-51.

Rapp, Carl S. (1993, January). "How to build a radio telescope," The Science Teacher, 60(1), pp. 35-36.

Rapp, Carl S. (1991). "Laser refractometry," Activities in Astronomy and Radio Astronomy, National Radio Astronomy Observatory, West Virginia University, pp. 128-130.

Rapp, Carl S., Kowalski, J., Muncey, B., Owens, D., & Roncella, J. (1985), McDowell County Curriculum Guide for Chemistry, Physics, Biology, and General Science.

Honors and Awards:

Who's Who Among America's Teachers, 1992.

University School Tandy Technology Scholar, 1992.

U.S. Department of Energy Research Associate, Pacific Northwest Laboratory, Summer, 1993.

One of 10 teachers selected nationwide to participate in the National Science Foundation's Center for Photoinduced Charge Transfer at the University of Rochester, Rochester, NY, Summer, 1994.

Tennessee Academy of Science Distinguished Science Teacher Award, 1994.

Northeast Tennessee Section of the American Chemical Society Outstanding High School Chemistry Teacher of the Year, 1995.

Who's Who Among America's Teachers, 1996.

Tandy Technology Scholar National Honorable Mention, 1996.

American Physiological Society Research Fellow, 1996-97.

Tandy Technology Scholar National Prize for Excellence in Science Teaching, 1997.